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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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THREE USEFUL GARDEN CHAIRS.

BY G. LE BRUN.

A HAMMOCK CHAIR—A FOLDING RECLINING CHAIR —A FIXED RECLINING CHAIR.

ALTHOUGH summer is almost over, yet out-door life is still so very pleasant it may be useful to give a brief description of three very simply made articles, that will well repay the trouble of making in the pleasure to be derived from their use in the garden or on the lawn during the fine days that are yet to come. Two (Figs. 1 and 2) are in general use in the eastern States of America, but I have never seen them in this country, although folding chairs of a similar nature are common enough. The material used should be good straight grained ash or oak, free from knots, as the toughness of these woods allows of good strength with a comparatively light scantling. The pieces of a given size can be had cut out at the wood-yard at a slight extra cost, but I think it is desirable, if the worker is not afraid of the hard work of the rip saw, to select a board of the requisite thickness and cut out the various pieces to the sizes required, as there is always so much more satisfaction from the reflection that the whole of the work is your own.

To begin with the hammock chair, as shown in Fig. 1, the pieces required for its construction are as follows :—

Two pieces for sides of back, 2 ft. 4 in.; two pieces for sides of seat, 1 ft. 2 in.; two pieces for arms, 11 in.; two connecting pieces under seat, 9 in.; two front legs, 1 ft. 5 in.; two upright pieces at front of arms, 1 ft.; two pieces for ends of foot-rest, 6 in.; one front piece for foot-rest, 1 ft. 6 in.

All the foregoing pieces are $1\frac{1}{2}$ in. wide and $\frac{7}{8}$ in. thick, and besides them there will also be required three rails, 1 ft. 4 in. in length. These rails may be either turned in a lathe or rounded with a plane, whichever way is the most convenient, and should be 1 in. in diameter; they are shouldered at the ends and a square tenon cut on them, in which put two saw cuts for wedging up. These rails are not, when finished, all of the same length, the front one at the edge of the seat being shouldered $1\frac{3}{4}$ in. shorter than the other two, the reason for which will at once be apparent by examining the illustration. The two longer rails are mortised into the side pieces at A and B. A fourth rail is necessary; it is placed at the foot of the legs, going through the pieces that support the foot-rest, and preventing their falling down from the horizontal position by its projecting ends bearing against the foot of the legs, C. This piece is $\frac{7}{8}$ in. in diameter.

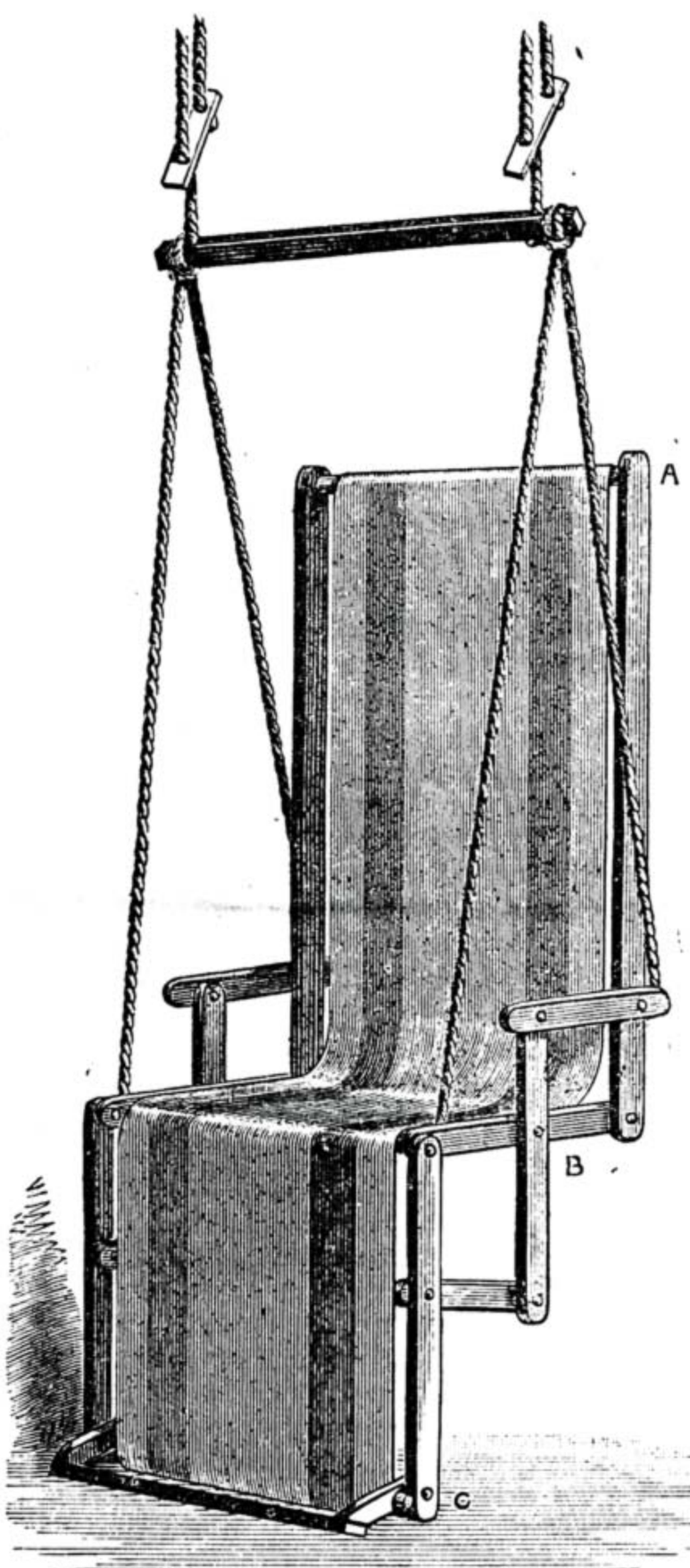


Fig. 1.—Hammock Chair.

The wood for the chair framing (with the exception of the rails described) is planed up all round, and the ends of each piece rounded to a half circle; $\frac{3}{8}$ in. holes are then bored to receive the rivets that hold the chair together, the position of which holes can be ascertained by a reference to the drawing. The rivets used are of copper and have a washer on each end. Insert them from the outside and rivet the ends over the washer on the inside of the framing with a small hammer; put in the rails with glue and wedge up tightly, then the chair is ready for covering. The cloth used for covering may be of any strong material—canvas will do, or a piece of stair carpet can be utilised, if handy.

A hanging bar, 2 ft. 3 in. long and $1\frac{1}{2}$ in. in diameter, is now made from which to suspend the chair, which is hung from it by sash cord, which should be of the best quality procurable, and is attached to the chair framing by boring holes at the positions shown, and, after passing the cord

Fig. 2.—Fixed Reclining Chair.

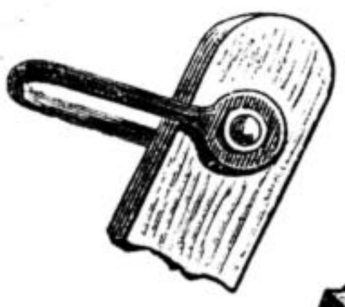


Fig. 4.—Enlarged Sketch of Loops in Fig. 3.

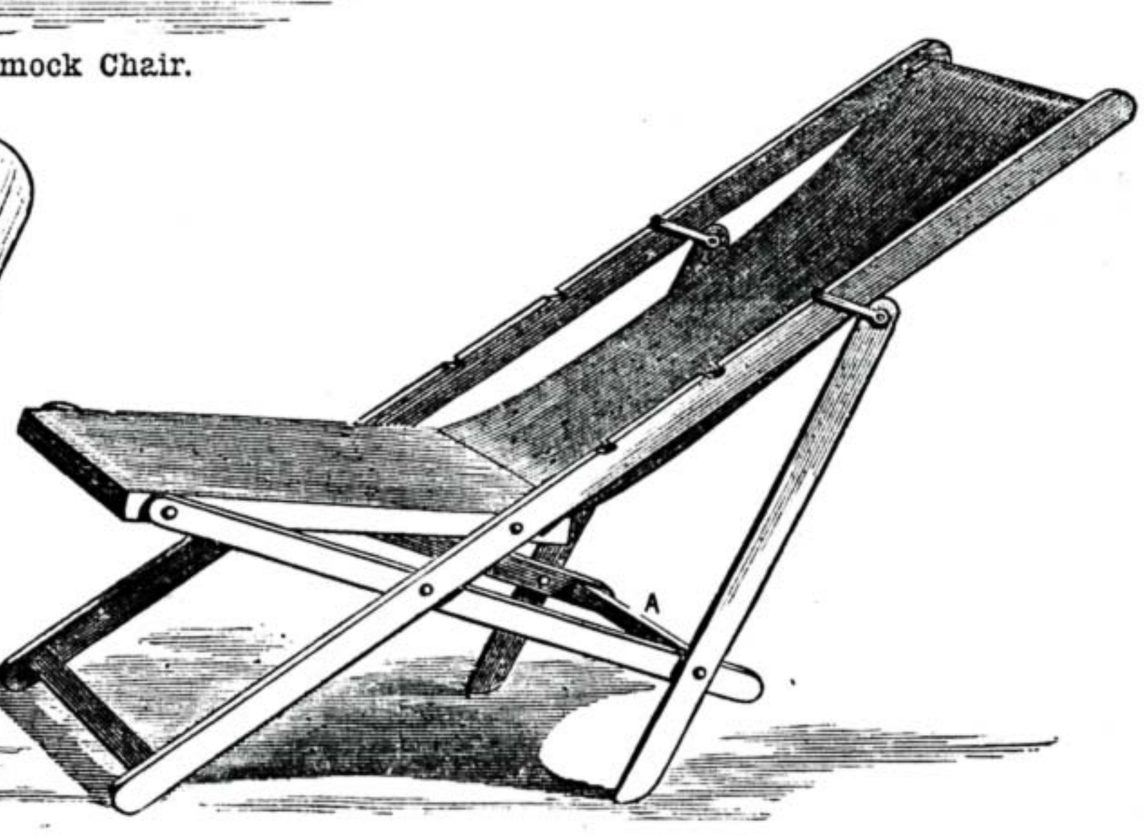
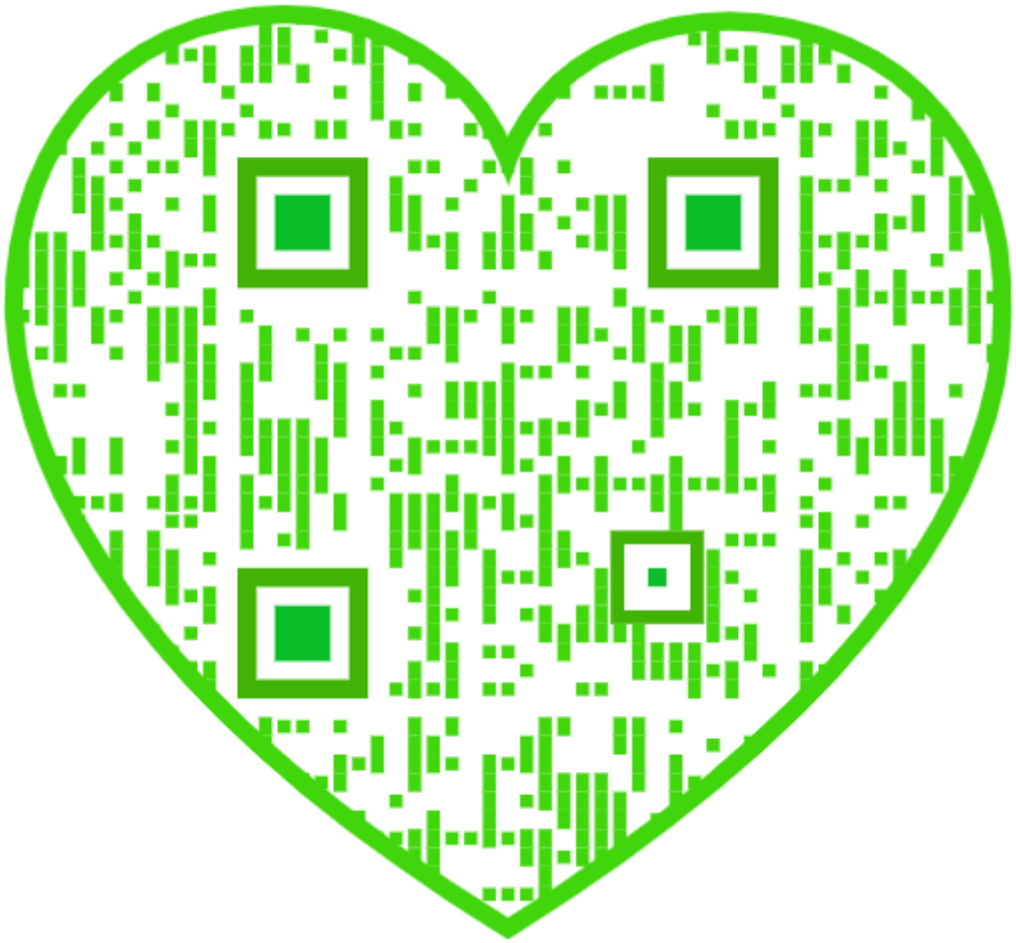


Fig. 3.—Folding Reclining Chair.



through, knotting the ends. The cross-bar may now be hung from the branch of a tree, or any other suitable support, by means of the arrangement shown, in which one end of a cord is attached to a wooden cleat, the other end passing through a hole in it, and then attached to the cross-bar. This method of hanging permits of an easy adjustment when put up on a branch or any support that may not be level. With the hanging of the chair is the end of the labour, and the maker can now enjoy his well earned rest in it while we go on to describe the other piece of garden furniture, which takes the form of a reclining chair, and the labour of making, which is not greater than that involved in the construction of the piece of work just finished.

For this chair then we require:—Two pieces for sides, 4 ft. 2 in.; two pieces for sides, 3 ft.; two pieces for seat sides, * 1 ft. 6 in. by 1 in. by 1 in.; two back legs, 2 ft.; two seat rails, * 1 ft. 4 in. by 1 in. by 1 in.; three turned rails, 1 ft. 4 in.

The scantling of these pieces (with the exception of those marked thus *, which are $1\frac{1}{2}$ in. square) is the same as in the previous job, viz., $1\frac{1}{2}$ in. by $\frac{7}{8}$ in.; they are planed up and rounded at the ends, except the bottom ends of the back legs, the position of the rivet holes being got from the drawing, Fig. 3. The seat is framed together by means of mortising and tenoning, and the turned rails put in in the same manner as those of the hammock chair, the lower rail at the back, A, being $1\frac{3}{4}$ in. shorter than the other two between the tenons. A visit to a blacksmith must be made for the purpose of getting the two loops that connect the top ends of the back legs to the sides of the chair, and allow of the legs being moved backwards or forwards to raise or lower the chair as required. These hoops are made of $\frac{1}{4}$ in. round iron, and are secured to the legs by $\frac{3}{8}$ in. rivets, that pass through holes in the ends. A series of three or four cuts is made on each of the sides of the chair to slip these loops into, which cuts should be about $\frac{1}{2}$ in. deep, and of sufficient width to allow of the loops being easily slipped in and out. An idea of the shape of the loops is given at Fig. 4, the length from the centre of the rivet hole to the inside of the closed end being $2\frac{1}{2}$ in. The chair is covered, in the same manner as the previously described one, with whatever strong material may be handiest, and the work is finished.

The various pieces of these chairs should be polished before being riveted together, as the operation is much easier than that when the parts are in position, and much vexation and trouble will be saved by doing so.

In addition to being useful in a garden, both of the chairs described are of much service on shipboard; the reclining chair can there be used as a deck chair, and the hammock chair can be slung up, in fair weather, to any suitable part of the ship's rigging; in fact, an amateur carpenter of my own acquaintance made two of these very articles recently for a lady friend of his who was going to New Zealand in a sailing ship from London, and has just received a letter in which the writer expresses much gratitude for the comfort afforded during the voyage by the use of his very suitable presents.

Both chairs can be set to any required angle, and one can either sit upright, recline, or lie, with much ease and comfort.

There is another and very simple form of chair, of which a drawing is given at Fig. 2. Ash, elm, or any tough light wood will do to make it. The framing, with the exception of the rails, is cut out of $\frac{7}{8}$ in. board, and planed up all round. The following are the lengths of the various pieces required, which are $1\frac{1}{2}$ in. wide:—Two back legs, 4 ft. 9 in.; two front legs, 2 ft.; two sides for seat, 1 ft. 6 in.; and two arms cut to a segment of a circle. Three rails are also required; they can be either turned, or rounded with a plane. The framing is halved and screwed together, and the rails mortised through the sides. The covering of the seat and back may be of canvas, but a piece of light-coloured carpeting is more pleasing to the eye. This chair is a fixture, and cannot fold up. This renders it not quite so portable as the other two described; but it has the advantage of being easily made, and requires no great skill to put it together, while its appearance, when nicely polished or varnished, is quite as pleasing as either of the others, and it excels them in the matter of rigidity.

SOLDERING IN REPAIRS OF SHEET METAL UTENSILS.

BY R. ALEXANDER.

TEA POT—TIN TEA KETTLE—IRON TEA KETTLE—COPPER TEA KETTLE—SOLDERING SOFT METAL—SOLDERING ZINC—GALVANISED IRON.

I WILL commence this article with a few simple examples of soldering in the way of repairs, none of which will present any great difficulty, and which will require very few tools beyond those already mentioned (p. 257). Let us suppose, for example, that we have the following articles brought us to repair—tin tea pot, tin tea kettle, coffee pot, saucepan, iron tea kettle, copper tea kettle. The first thing is to examine them, and find out what is the matter with them; on holding the tea pot up to the light and looking in the top a small pin hole is seen in the bottom; we put it down that that is the faulty place, make a ring round it with a bradawl and put it on one side. Taking up the tin kettle, and treating that in the same way, we are unable to discover any holes in it, and, on farther examination, no sign of a leak is discoverable. So it must be tried with water; we then find that the water oozes out at the side of the spout; mark it with the bradawl, and try coffee pot. On treating this in the same manner, nothing seems wrong with it, but as the knob is missing we will put it down that a knob is what it requires; the saucepan we find to have the same fault as the tea pot, viz., a hole in the bottom; the iron kettle we find to leak all round the spout, and the copper kettle has a crack about $1\frac{1}{2}$ in. long at the angle where the bottom and sides meet.

Tea Pot.—Now to remedy these defects. Take the tea pot and, with a scraping knife, scrape a clean place round the pin hole about the size of a sixpence. While mentioning the scraping knife, I may as well say that an old razor driven into a file handle makes about the best scraper you can have, though for some things a more pointed one is required, but for all ordinary work the razor will be found sufficient. Have all your soldering tackle handy, iron, solder, spirits, spirit brush, and piece of solder; heat the iron, hold the tea pot in the left hand, dip the spirit brush in the spirits, rap it against the sides of the jar to remove superfluous liquid, and apply a little to the place you are going to solder. Then take the iron, dip it in the spirits to clean it, apply it to the piece of solder, and try to pick a little up with it; you will probably find this a little difficult at first, the solder seeming to take a delight in running all over the bench instead of clinging to the iron. The way to do it is this:—Hold the iron in a nearly horizontal position, and, in applying it to the solder, do not dig the point of the iron into it, but lay the side of the iron on it lightly near the point and draw the iron toward you; then, keeping the iron as near horizontal as possible, bring the point of it with the solder it has picked up to the hole in the bottom of the tea pot. As it touches the leaky place lift the handle of the soldering iron, and the solder will flow off at the point; move the iron just round the hole and the solder will run all over it. Take the iron away, and allow the metal to cool (blowing on it will accelerate the cooling), and the tea pot is done. Try with water to make sure that it is sound.

Tin Tea Kettle.—The next job is the tin tea kettle. A few words will suffice for this. Dry it thoroughly, scrape it well a little farther each way than the leak extends, hold it in the most suitable position for soldering, which will be on its side, spirit it and solder as just described, laying the angle of the iron in the angle formed by the spout and body. The coffee pot knob is also a very easy job. Simply place the new knob in the hole (after scraping, of course), and with the iron melt a little solder and the end of the knob together, letting the knob rest on the bench whilst soldering, and taking care not to keep the iron on it too long or it will melt the knob away and spoil it; a little stud is usually punched out and soldered over the place where the knob is fixed to give it a neat appearance.

Iron Tea Kettle.—The iron tea kettle next demands attention. Most wrought iron kettles are tinned outside as well as inside before being japanned. If on scraping the black off this proves to be the case, and it has not been in use very long, the scraping knife will be all that is required to clean it for soldering, but if old and rusty round the spout, say, through having been put by when the leak was discovered, instead of being sent to be repaired at once, then the file will be required; a 10 in. half-round is about the most useful for these jobbing operations. Carefully clean all round the spout till you are sure there are no dirty places or rust spots. When sufficiently clean, apply the spirits as before mentioned; heat the iron to a good heat, apply the solder by holding a strip of it in one hand and melting a little on with the iron held in the other; holding the kettle with your body against the bench, draw the iron round the spout and the solder will follow. Let the iron rest on the work, as it must be got hot before the solder will unite to it properly; a strong job cannot be made unless the parts to be united are as hot as the metal that is to unite them. For example, supposing the kettle we are just supposed to have done had been coated with fur to the depth of half an inch all over the inside, you would have found that you could not have got it hot enough for the solder to flow freely, on account of the wet fur robbing the heat from the iron as fast as it was communicated to it, and although you might have managed to stick a little solder round the spout, it would not have been a good sound job, but if the fur was cleaned out the difference would at once be felt. This remark about fur applies, of course, to patches on bottoms or sides.

The next job on hand is the saucepan. This

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having only a small hole in the bottom, may be treated the same as the tea pot, especially if a small one and of little value, but a better and a more workmanlike way will be to put a piece on it; people would also rather pay a little more for a patch than if only a "dab" of solder were put on, though a patch soldered on is very little, if any, better than mending it with solder, as far as utility goes, for this reason, that if by any chance the saucepan should be left on the fire without any water, the patch would melt off as easily as the solder. But as a patch looks better and the customer will be better pleased, let us put a patch on by all means. Cut a piece of tin about an inch square, snip off the corners, lay it on the bottom of the saucepan just over the hole, mark round it with the brad-awl, scrape clean all the inside of the square thus marked, and ¼ of an inch all round the outside of it; or in other words, if the patch is 1 in. square scrape a clean place 1½ in. square. If the saucepan is in good condition and scrapes nice and clean, it will be ready to solder; but in case the bottom is eaten by fire and rust it is difficult to get clean, and after scraping and cleaning it as well as you can, you must "tin" it to make sure of the solder flowing under the patch. To do this, simply rub the soldering iron over it with a little solder, applying spirits to make it tin easily. When this is done, lay the patch on and solder it, drawing the iron first round the edges and then all over it, holding the patch down with something to prevent its shifting, the solder flows underneath, and the patch is what we call "sweated" on. The description of putting on a patch applies equally to other article such as tea kettles, coffee pots, fish kettles, etc. With the exception that a large patch need not be sweated all over, but simply soldered all round the edge of the piece, letting the iron rest mainly on the piece that is put on rather than on the article, this is to draw the metal underneath.

Copper Kettle.—The next and last example of the batch we are at present considering is the copper kettle. This, as we have seen, is supposed to be cracked along the edge of the bottom about 1¼ inch. This must be repaired by putting a patch on the bottom and turning it up on the side. Scrape clean a place on the bottom 1 in. wide, and extending a little each side of the crack, scrape up the side ½ an inch in the same manner, tin the places as described previously in speaking of the saucepan; now take a piece of thin copper 1½ in. by 1 in., clean it both sides and tin one side with the soldering iron, it will then be ready to put on. I always fix such a job as this in the vice by the handle, as that leaves the hands at liberty, and place the piece of copper, tinned side down, on the bottom of the kettle, leaving about ⅜ of an inch overlapping to turn up on the side. Solder the piece on to the bottom, cut the overlapping piece to the same sweep as the sides, and with a light hammer rap it close up to the side, and then solder round that part; clean off any superfluous metal that may have run on to the patch with a file or scraper, and if thought necessary, colour the solder with a little solution of sulphate of copper, more commonly known as blue vitriol or bluestone. Crush a small crystal of the sulphate, dip a small brush (not the spirit brush) in water, and with it touch the powdered sulphate and then draw the brush over the solder; this will give it a copper colour, but, of course, not lasting. The half-dozen jobs that I have described will serve as a model for all of a similar class. In fact, if I were to describe fifty such jobs, they would all amount to the same thing, that to make a good job you must get the place to be repaired or the surfaces to be united perfectly clean and bright, or you cannot solder them properly. If this is carried out and the iron is properly tinned and cleaned, and the solder all right, everything else is sure to be, always supposing the worker to possess the proverbial "grain of common sense."

Soldering Soft Metal.—I will now say a few words on soldering soft metal. This will require a little more skill and practice to master, and I should advise learners to get an old metal tea pot or two and practise on, before attempting to perform on the family plate. One or two things need be observed to ensure success. The metal must be scraped bright, because a tea pot or coffee pot looking clean is no criterion that it is clean enough to solder properly, next a light soldering iron should be used, as you dare not rest the iron on the work as you would in soldering tinware, or the result would be disastrous. So the weight of the iron being all on the wrist, I say use a light one or you will not be able to hold it steady.

Thirdly, the iron must be just the right degree of heat. If it is too hot, the chances are that a hole in the metal will be the result of its application, and if not hot enough the work looks botchy. Try to hit the happy medium, the old tea pots will be good practice. Let us suppose one leaks all round the spout. If it has been in use just lately, the first thing to do is to dry it out thoroughly, or on applying the iron the solder will splutter about and bubble up instead of flowing nicely. Having dried it well, the next thing will be to scrape it, the large blade of a penknife is a very good thing for this, then take some very fine running solder, and have ready some resin and oil for a flux; apply it round the spout with a little brush, heat the iron, apply a little solder to the tea-pot spout, and gently draw it round with the iron, scarcely letting it touch the metal of the tea pot. The heat of the solder will melt the metal as you draw it round; if the iron is fairly hot, do try not to make the solder run round too far, but keep picking more up and reheat the iron when you find it hang. Supposing that you have got safely round the spout, the next thing is to clean off the job so that it can hardly be seen where it has been repaired. A small half-round file about 6-in. long will be the best thing to use. Work round the job lightly, taking care not to file the sides and spout of the tea pot more than you can help, and when you have got it fairly level and smooth go round it with emery cloth or a scraper; the scraper must be round-ended, if pointed like a penknife blade it would make more marks than it took out. After this use a steel or agate burnisher and a capital job is the result. The first try may not be a success; but I have found out by experience that our failures teach us as much as our successes.

A very ticklish kind of work is the repairing of the rims and covers of china tea pots, and hot water jugs. These covers and rims are extremely thin, and made of a very soft and fusible metal, and therefore they require very great care.

The parts to be soldered must be carefully scraped, no streaks of uncleaned metal should be seen, very little flux should be used, and a very steady hand is required. If these directions are attended to, there is little fear of failure or spoiling the work. I have never yet spoilt, or even had an accident with any work of this kind, even in my 'prentice days, and there is no need for my readers to do so if they take pains with their work and use care; but if you attempt to do such work as the last two things I have mentioned, as I have seen some do, with a dirty iron, tin nearly all burnt off, the work half cleaned, and using common solder, it will not be strange if failure is the result.

Soldering Zinc.—This is a difficult metal to solder smoothly and well, even when new and clean; and when old, such as guttering that has been fixed a long time, or old kitchen utensils, it is much worse. In soldering this metal, the strong or raw spirit of salt must be used, and the worker must try and keep the spirit to the part to be soldered, and not let it run all over the work; and after the seam joint, or whatever it may be, is soldered, the spirits should be wiped off as soon as the work is cold, as the spirits have a very corrosive action. Soldering zinc is not a very pleasant job for the olfactory organs, as the smell caused by applying the acid to the zinc is, according to most people's idea, "something awful;" however, use is second nature, and I don't mind it much myself. You will also find that the solder does not flow very well on zinc; this is because a certain amount of it mingles with the solder and deteriorates it, and you will find that it will cling to and get hard on the iron like a lot of dross. The iron will require to be cleaned at intervals if much zinc is being soldered; a light touch up with a file all round, and a rub on the sal-ammoniac with a little solder puts it all right again. Old zinc will require to be got fairly clean with a scraper or file before attempting to solder — use spirits freely.

Zinc is not a soft metal like pewter, but it will melt under the iron if thin and the iron is very hot, so use care in this respect; practice will soon show the right degree of heat to work with. Smooth the soldering where rough with file and scraper. The ordinary plumber's shave hook is a good tool for cleaning off zinc after soldering, especially on long seams such as would occur in joining two sheets together.

Galvanised Iron.—The treatment of this is very similar to that of zinc, strong spirits being used as the flux. I would also advise that anything in zinc or galvanised iron that is to contain any liquid, should be very carefully tried before passing it as done, as though you may fancy that it is all well and truly soldered, yet both zinc and galvanised iron are such treacherous things to solder that it is almost impossible to say with certainty whether it is sound or not, and nothing is more discreditable to a workman than to have his work returned leaky, solely for the sake of a little extra trouble, to say nothing of the inconvenience that might be caused.

The directions given above for the repairs of ordinary metal utensils in common use, will be found sufficient for the renovation of all articles of this description. Although the articles themselves may differ in form, the mode of going to work to mend them is the same in every case. So that although but few articles have been mentioned, the instructions given apply similarly to all that are made of the plain and tinned iron, copper, and soft metal. If any workman can make a good job in one case, he may depend on being able to arrive at the same result in all others of a similar character.

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MAKING BOLTS AND SCREWS FOR MODELS.

BY OLLA PODRIDA.

ALTHOUGH such small work may be purchased cheaply, it is nevertheless not always convenient to do so for several reasons which should be obvious. First, there is the delay, which—when the model maker is, as such people generally are, in a fever of impatience—is a very important matter. Then there is the difficulty of obtaining just the right length and size for particular cases, and this may involve alterations, and, consequently, more lost time and patience. All this goes far towards balancing the bother of making such small goods oneself. I know from experience that model bolt-making isn't a very congenial occupation; in fact, it may be considered a necessary evil, but then there is the satisfaction that you are making exactly what you require.

Some years ago, while suffering from a severe attack of model mania, and having a large number of very small screws to make, it occurred to me that some simple means might be devised whereby the labour of turning such small articles might be greatly reduced. An idea suggested itself, and was immediately put into practice with very satisfactory results. The device then employed is now reproduced and illustrated herein. It has at least one merit, that of simplicity both in manufacture and use, and I trust it may be of service to those interested in WORK.

Tool for Making Bolts and Screws for Models.

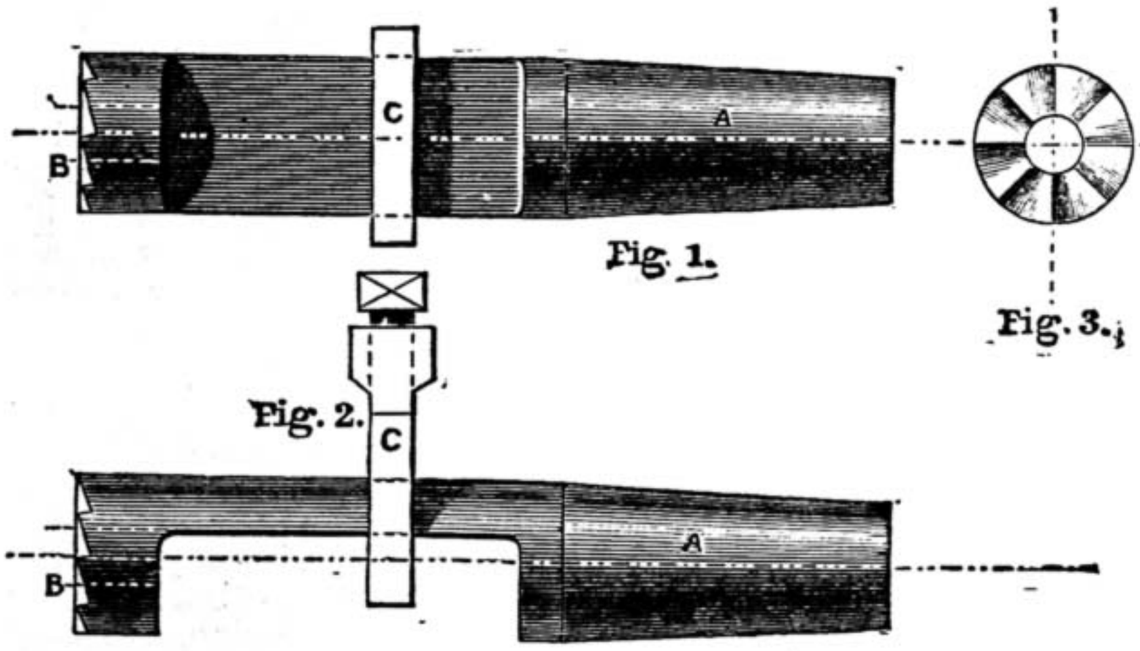

Fig. 1.—Front Elevation of Tool. Fig. 2.—Plan. Fig. 3.—End Elevation or View of Cutting Face. Fig. 4.—Section Showing the Gauge or Stop which regulates Length of Bolt.

Fig. 1 shows a front elevation of the tool; Fig. 2 is a plan; Fig. 3 is an end elevation, or view of the cutting faces; and Fig. 4 is a section shewing the gauge or stop which regulates the length of bolt. The tool is made entirely of steel, and for this purpose a worn-out round file may be economically used up. A separate one is required for each size bolt to be made, but, if desired, this may be avoided by making the body of iron and boring the end out larger, so as to accommodate a series of steel cutters with different size holes as required, these cutters being held by a small set-screw so that they may be changed when desired.

In making a tool of the form given herein, the first thing is to get a piece of steel of suitable size, and soften it for turning. The softening may readily be done in the kitchen fire, by heating it to a blood-red heat, and burying it in fine ashes or quicklime until it cools. It is then centred truly and turned to the required size, the tapered part at A being made to fit the poppet cylinder. The centres should be left in for—at least, in the case of the cutting end—convenience in boring the hole to size of bolt. In the illustration this is given for bolts $\frac{3}{16}$ in. in diameter, and the outside size of tool is $\frac{1}{2}$-in. The hole is best drilled by means of a running drill held in a chuck, the tool being fixed in and advanced by the poppet cylinder. The hole need not be made deeper than just to clear the solid end, say $\frac{3}{8}$ in. deep. A nice smooth hole is required, so as not to injure the body of the bolt. The next thing to be done is the filing away for the flat part to clear the hole, as shewn in Fig. 2 and in section at Fig. 4. This having been done, the cutting faces may next be formed. There are eight of these equally divided. They are formed by filing, and must be finished smoothly. Their formation will be facilitated by making them deeper on the outside, or by slanting the file so that it shall clear the opposite edges at first, and afterwards finishing by short strokes with the point of file. Care must be taken to bring the sharp cutting edges quite true and square to the axis; this, if the end has been nicely faced in the first place, will be comparatively easy.

The tool must now be tempered as follows:—First heat the cutting end to an even blood or cherry red heat, and plunge quickly into lukewarm water. Next brighten the outside of the cutting end by means of a piece of sandstone or brick. Then heat red hot a piece of iron—one of the domestic box iron heaters will suit admirably—and lay the tool upon it, turning it meanwhile to equalise the heat, until it assumes a dark straw colour tinged with blue, when it must be immediately cooled in lukewarm water as before. The tool is now, with the exception of the stop, ready for use. The stop may be made out of a small piece of flat iron, and the hole in centre should only just be large enough to clear over the cutting end. It can by means of the set-screw, s, be fixed in any required position, according to the length of bolt, but, although convenient, it may be dispensed with.

The method of using the tool is as follows:—Wire of suitable size having been obtained, it is held in a chuck so that sufficient projects to enable one bolt to be made and parted off. The wire must be large enough to form the head, and the chuck may be an ordinary "pod" or drill chuck. It should be capable of accommodating sufficient wire for making a number at a time. The tool is, as has already been observed, held in the poppet cylinder, and the poppet head fixed in a convenient position for advance and withdrawal of the tool. The gauge stop having been set, the wire must be pointed and rounded slightly to enable the tool to start fair and give a finish to the point of bolt. The tool is then advanced steadily by hand, and kept well lubricated with soap and water, or oil. When the stop is reached the tool is withdrawn, the head turned up, and the bolt parted off with hand tools and tee-rest. If a hexagonal or square head is desired, the sides can be filed up, and the angles or corners chamfered before parting off. The process of screwing or threading the bolt should follow the turning, and before forming the head, so that in case of stripping of the head a minimum of trouble may be met. The lathe should be run at a smart speed during the operations except for screwing, which must be done by hand, the die or screw plate being held in one hand and the work gently pulled round by the cord with the other.

SIGN WRITING AND LETTERING.

BY HENRY L. BENWELL.

VI.—THE SIGN WRITER'S OUTFIT—ITS CARE AND TREATMENT—MATERIALS AND COLOURS.

"A BAD workman always complains of his tools;" so runs the old proverb, but it is nevertheless true, that to do good work we require the best of tools to do it with, and, also, that the result of using bad tools is indifferent and unsatisfactory work. I am, therefore, now going to describe the best and most durable tools required by the sign writer, and also give a few hints and directions as to their proper use and care when lying idle. This latter point must never be neglected, but always attended to immediately the tools are done with, otherwise the pencils will soon become worthless; at least for doing good work, besides causing an unnecessary outlay for new ones. Badly kept tools are also a sure sign of the owner being a slovenly and lazy workman; so I would strongly urge the apprentice or young workman, at the very commencement of his tuition, to take a pride in keeping in workmanlike condition and business order what will through life, perhaps, prove his best friend, his bread winner and his trade mark, viz., his "kit of tools."

I would not advise, under any circumstances, the purchase of cheap and badly made tools; those of the best quality only are always the cheapest in the end, both as regards wear and tear and the turning out of good work. This remark applies specially to camel-hair and sable pencils, and the colours and vehicles used in sign writing.

If the reader will, however, only follow the advice contained in this chapter, on procuring a complete outfit for sign writing, he will, I feel sure, never have to complain of his tools, even though, through his own negligence, he may become but a bad or indifferent workman. The brushes and pencils first demand our attention, so I will dismiss them with a few but weighty words.

The hair pencils used by sign writers are made in various sizes, and the student will do well to obtain a complete set as soon as he can afford it. He had better, however, commence with a few good pencils in preference to a host of common rubbish. I need hardly say that the student must choose his brush or pencil according to the size or nature of the work he has in hand; the small pencils being used for fine and delicate work, and the larger sizes for large lettering. The

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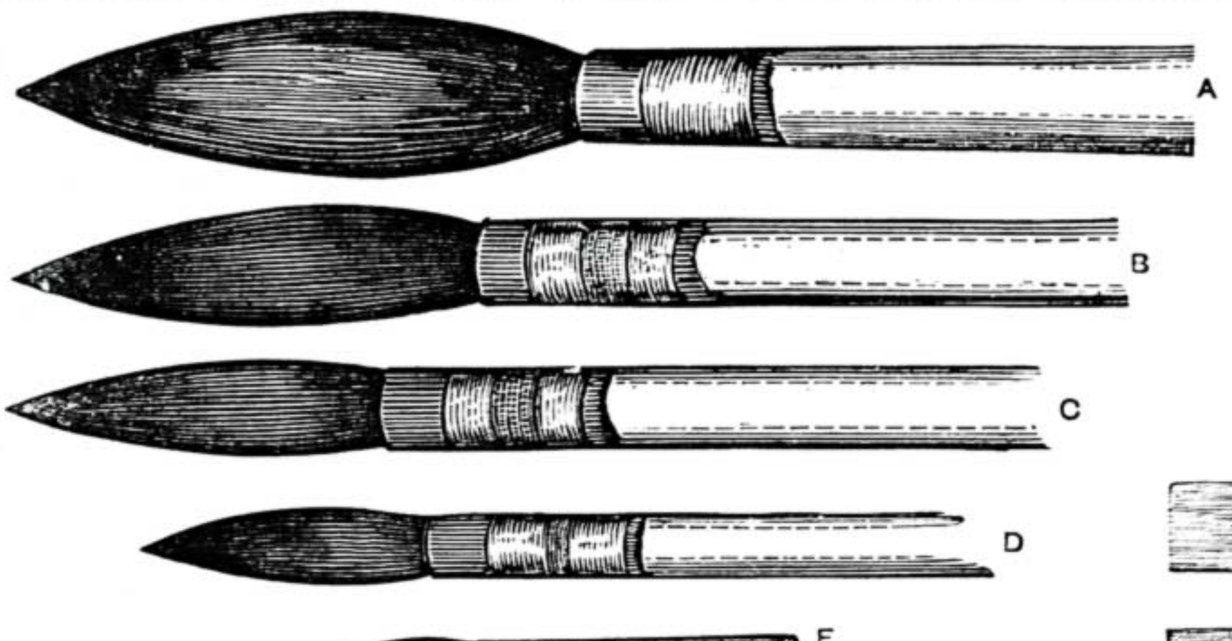


Fig. 39.

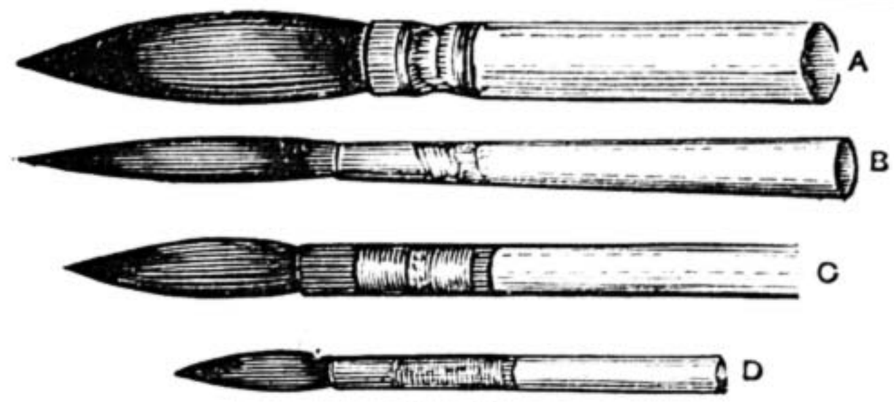


Fig. 42.

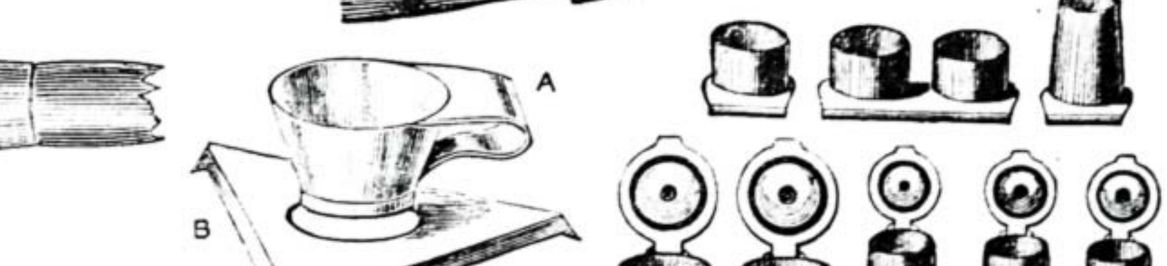


Fig. 43.

Fig. 40.

Fig. 41.

Fig. 44.

Fig. 44a.

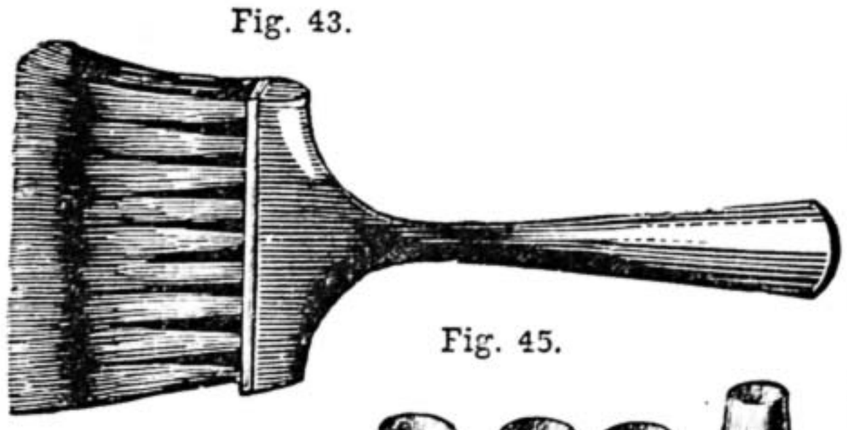
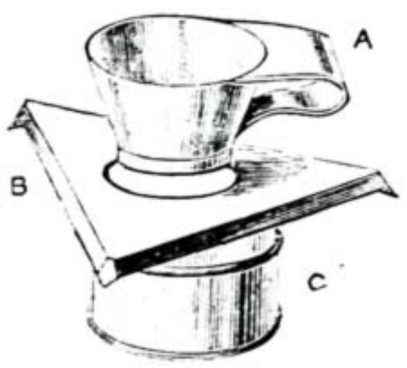


Fig. 45.

Fig. 46.



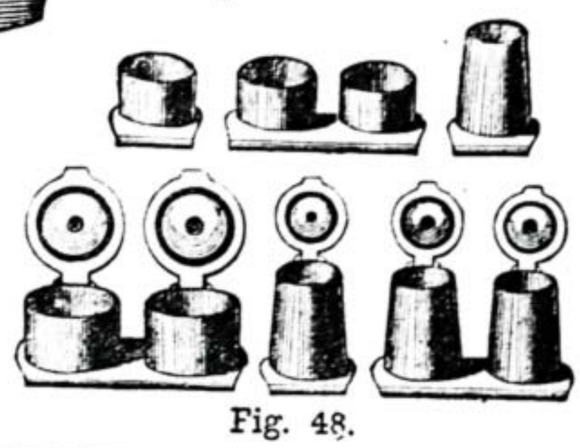


Fig. 48.

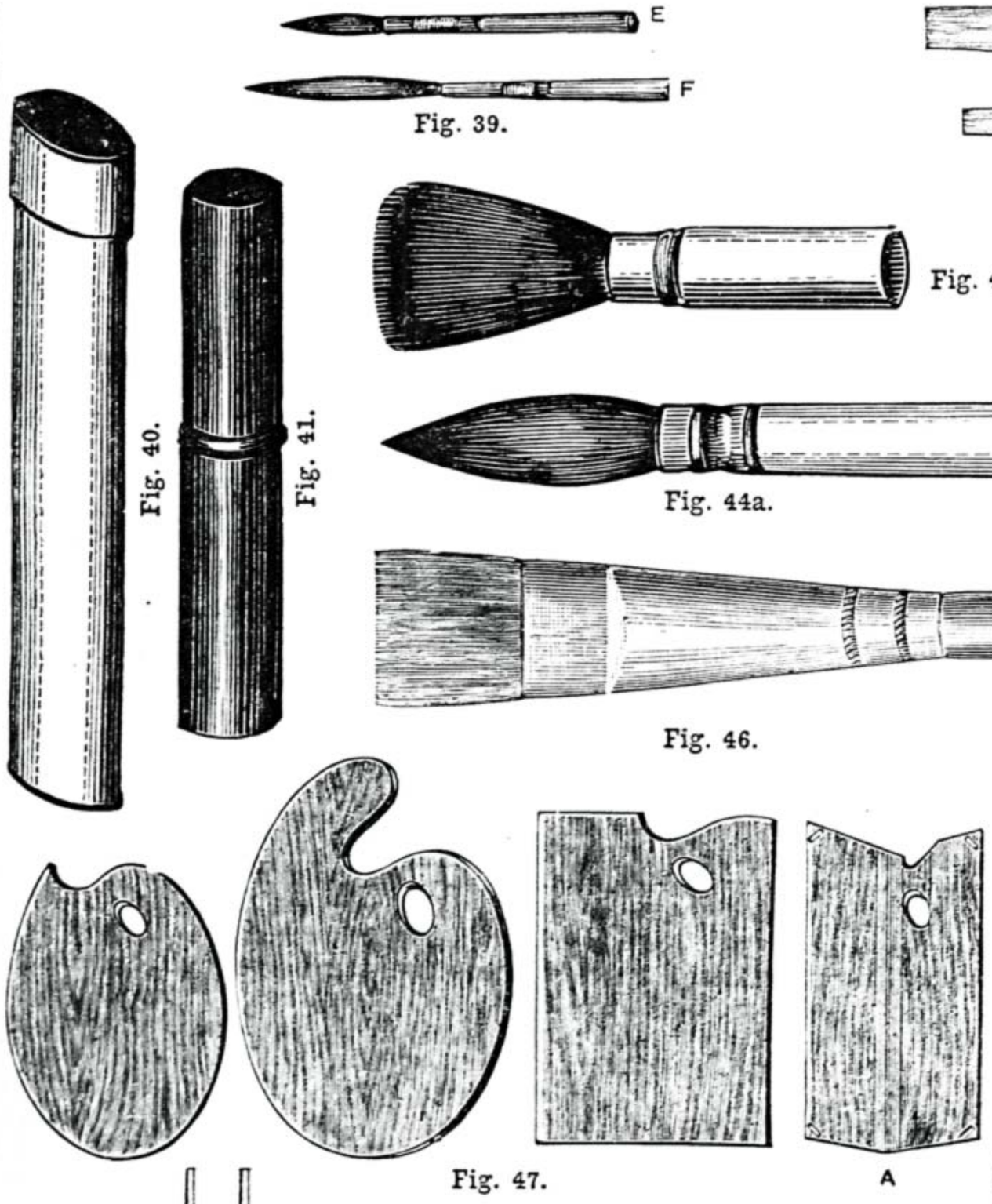
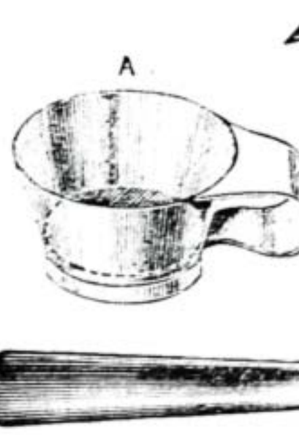


Fig. 47.



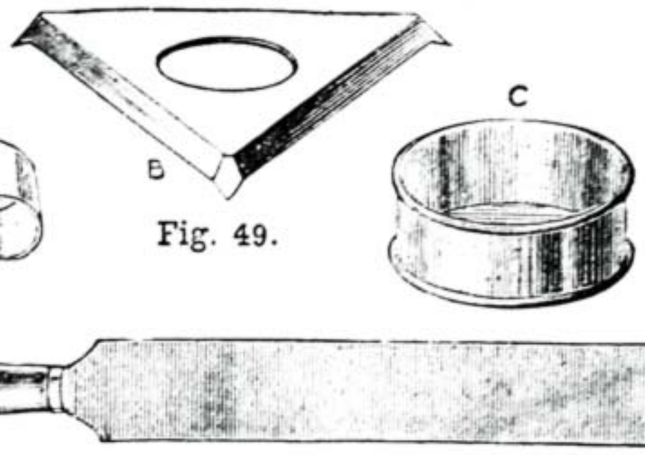


Fig. 49.

Fig. 50.

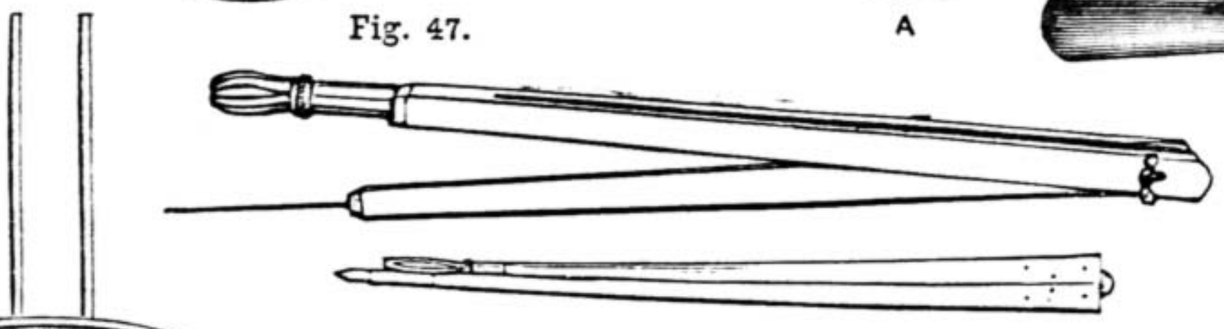


Fig. 51.

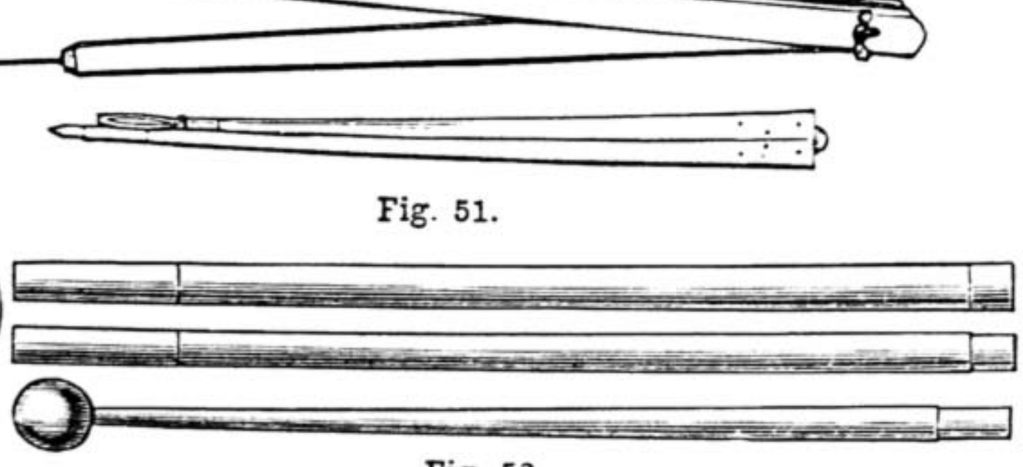


Fig. 52.

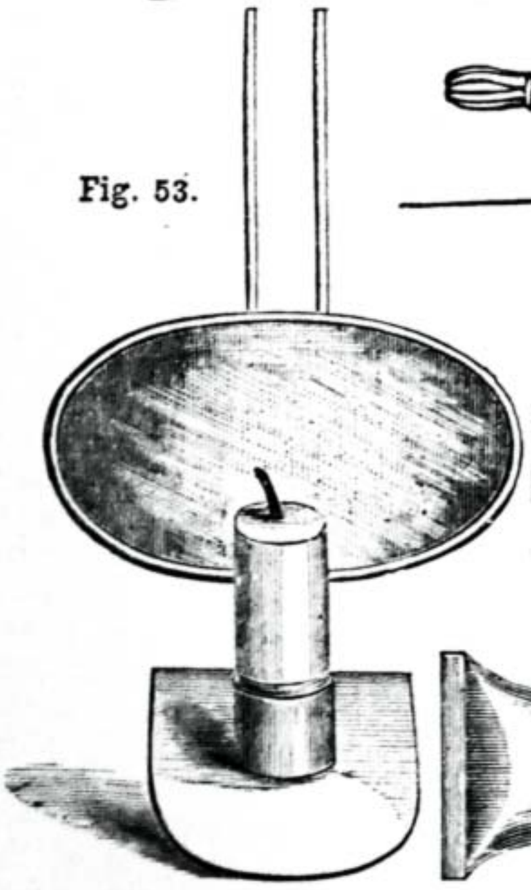


Fig. 53.

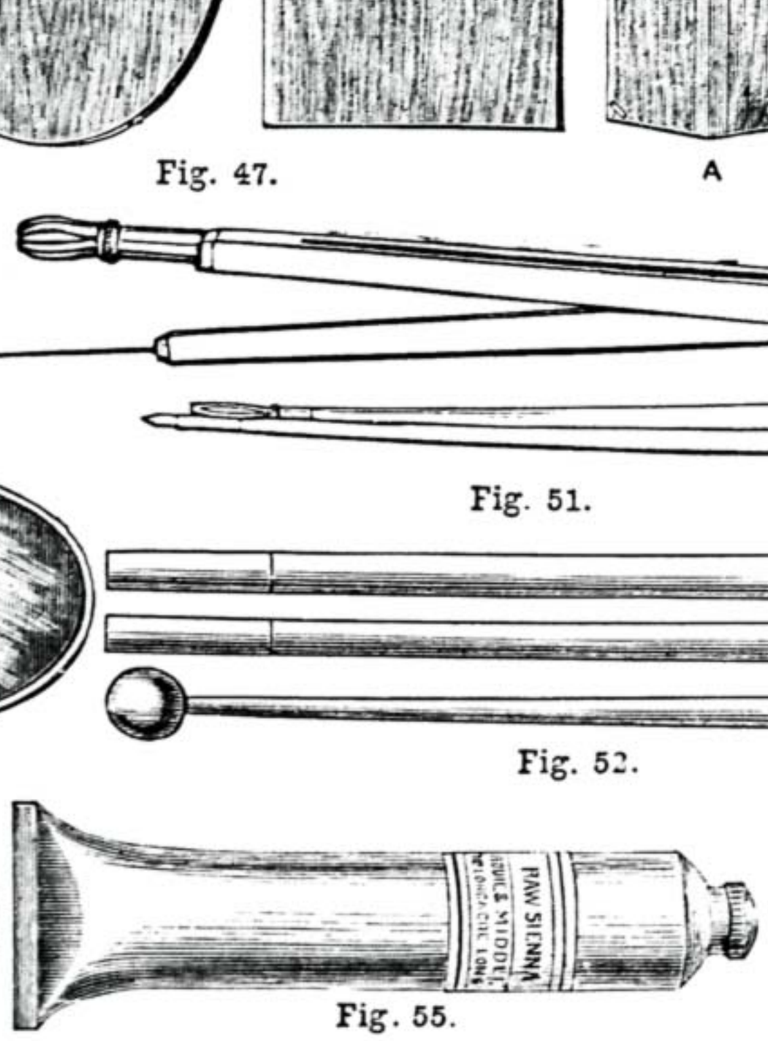


Fig. 55.

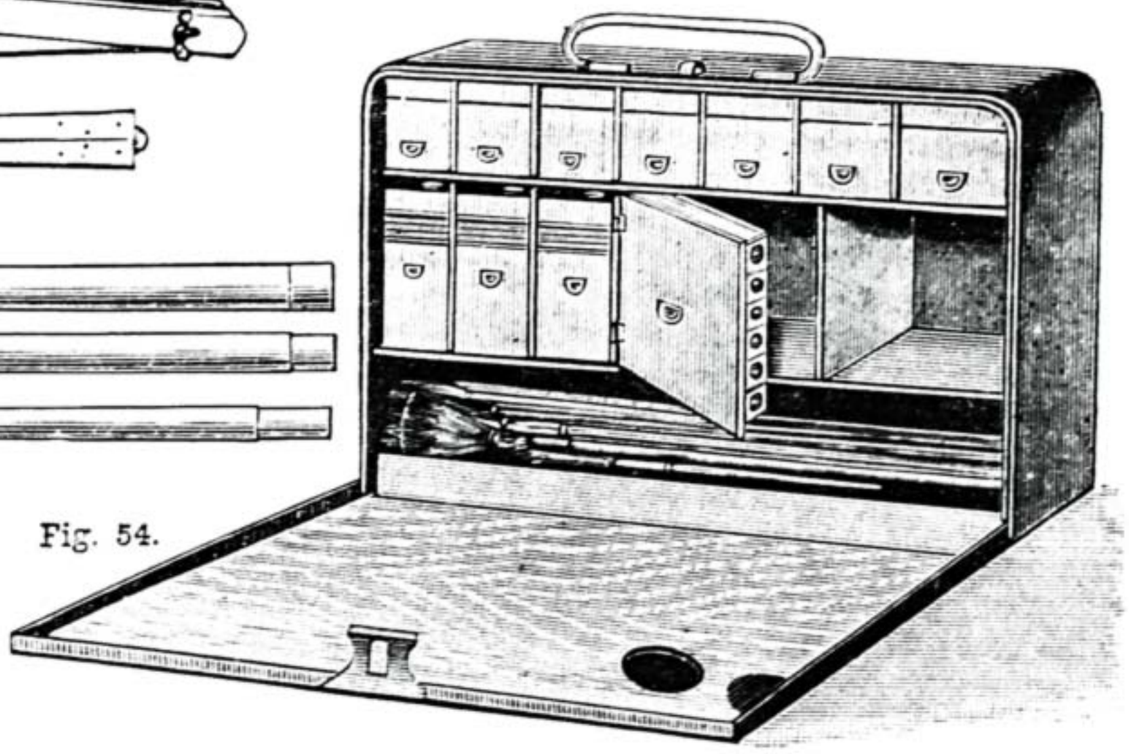


Fig. 54.

Fig. 39.—Writers—A, Large Swan; B, Small Swan; C, Goose; D, Duck; E, Lark; F, Crow. Fig. 40.—Oval Pencil Case. Fig. 41.—Round Pencil Case. Fig. 42.—Riggers—A, Goose Short Pencil; B, Duck Short Pencil; C, Crow; D, Lark. Fig. 43.—Liners or Tracers—A, Goose; B, Duck; C, Crow; D, Lark. Fig. 44.—Short Hair or Filling-in Brush. Fig. 44a.—Filling-in Brush with Tin Ferrule. Fig. 45.—Badger Hair Softener or Blender. Fig. 46.—Writer's Sable Blender. Fig. 47.—Mahogany Palettes. Fig. 48.—Dippers, Single and Double. Fig. 49.—Sign Writer's Paint Strainer—A, Strainer; B, Stroddle; C, Water Dish. Fig. 50.—Palette Knife. Fig. 51.—Divider and Compasses. Fig. 52.—Jointed Mahl or Rest Stick. Fig. 53.—Sign Writer's Candlestick with Shifting Reflector. Fig. 54.—Brodie and Middleton's Sign Writer's Complete Outfit in Japanned Tin Box. Fig. 55.—Tube Colour for Sign Writer.

pencils are made in the following sizes, viz.:—

Lark or Miniature.	Goose.	Small Swan.
Crow.	Full Goose.	Middle Swan.
Duck.	Ext. full Goose.	Large Swan.

The most useful sizes will be found illustrated in Fig. 39.

Camel-hair writers are, of course, the cheapest, and for some work they may be used without inconvenience; but when heavy colours are used they are useless, as the colour by its weight causes them to droop or "sagg," so that it is next to impossible to get a sharp, clear outline. Sable pencils are, therefore, the best (although more expensive), the hair being stiffer than camel-hair, whilst at the same time it is just as pliable and considerably more durable. To last even a short time, however, they must always be kept to perfection, and at once cleaned on the completion of a job. This is best done by first rinsing the pencils in some turpentine, then washing with some soap and warm water, and finally dipping the points into some sweet oil, and putting away in a tin case (Figs. 40 and 41). Most workmen merely grease them, for which purpose they have a little compartment in the tin box for holding a small supply of grease, and some keep them always in a little sweet oil at home. It is always best though to thoroughly clean them, as experience will teach. A very good receptacle for the pencils is a long tin box which has contained wax vestas. The sixpenny size is the most useful, and as these can be picked up almost anywhere, the young workman may soon possess as many as he requires. The wooden handles should be removed before putting the pencils away. The writer will eventually require some "riggers," or short hair pencils (Fig. 42), some "liners" (Fig. 43), and some full, short hair or "filling in" brushes (Figs. 44 and 44a), the use of which will be described in a future chapter. The badger-hair softener (Fig. 45) is used for blending two or more colours on any large surface, and the sable blender (Fig. 46) is used for the same purpose in shading letters and blending their colours.

We next come to the wooden palettes, which are held in the left hand, and are used for mixing and working the colours upon. They are made in various shapes and sizes, as shown in Fig. 47. The last (A) is a folding palette for the pocket, etc.

A few tin dippers are very useful appendages to the palette (Fig. 48). They are made with a flange for sliding on to the edge of the palette. Dippers are used for holding small quantities of tube colours, oils and turps, so as to have them close at hand.

A small paint strainer should be possessed by every sign writer, and the most useful one that I know of is illustrated at Fig. 49. It is named Thomasson's Improved Registered Paint Strainer, and is made by Crowden and Garrod, Southwark, S.E. This strainer is designed to meet the wants of the sign writing trade; the triangle stroddle will rest over any sized paint pots, and there is a water dish for keeping the strainer in water when out of use. It is made of stout zinc, with brass wire gauze, and, having used one for some time, I can say that they are durable, easily kept clean, and cheap. The price for the medium size is about 2s. 6d.

One or two palette knives (Fig. 50) will be needed, and their price ranges from a shilling upwards. The dividers (Fig. 51) are used for many purposes, such as measuring out spaces and describing arcs, circles, ovals, and scrolls.

One of the most useful and handy appliances ever brought out for the sign writer is the "jointed" mahl stick, as made by Brodie and Middleton, of Long Acre. It has three or four divisions, and takes to pieces after the manner of a fishing-rod, so that any number can be used, and the stick brought to any desired length according to the nature of the work (see Fig. 52). When taken to pieces it will go in the baskets, box, or pockets. The same firm also make two specialties for the sign writer, one is a candlestick, and the other a complete outfit in a tin box. The candlestick (Fig. 53) is furnished with a shifting reflector, so that the light can be thrown on any particular spot. It is also fitted with a flange for attaching to the palette. This article is very useful when working after sunset awhile in order to complete a job, or for evening practice on the black board.

The guinea sign writer's box (Fig. 54) is made of japanned tin, and it is really a most useful servant to every sign writer. It is fitted in a very complete manner, and contains every requisite that can possibly be required. There are a series of compartments, with tightly fitting lids, to contain the colours, so that there is no danger of their getting accidentally mixed and spoiled, as is often the case when they are carried loosely in a basket. There are also bottles, with screw lids, to contain oils, turpentine, varnishes, and other diluents; spaces for gold leaf, brushes and pencils, and a palette. The spaces for the whole of these articles is so nicely adjusted that there is a maximum of convenience with a minimum of bulk. I need hardly say, how very superior such a "multum in parvo" must be to the cumbrous baskets which writers and grainers ordinarily carry, to say nothing of the superior cleanliness of the japanned box over the old method.

The young workman will also require some sticks of pipe-clay, a chamois leather, a good sponge, cotton wool, and a chalk line and reel, all of which may be obtained from Brodie and Middleton, besides the pencils and the colours; a list of which I now append.

TUBE OIL COLOURS USED BY SIGN WRITERS.

Verona Brown.	Cologne Earth.
Yellow Ochre.	Yellow Lake.
Caledonian Brown.	Purple Lake.
Roman or Golden Ochre.	Indian Lake.
Brown Ochre.	Lake.
Raw Sienna.	Ivory Black.
Burnt Sienna.	Lamp Black.
Prussian Blue.	Blue Black.
Antwerp Blue.	Terravert.
Indigo Blue.	Verdigris.
New Blue.	Flake White.
Pale Ultramarine Blue.	Cassell Earth.
Deep Ultramarine Blue.	Blue Verditer.
Permanent Blue.	Zinc White.
Magenta.	Crimson Lake.
Mauve.	Scarlet Lake.
Olive Green.	Vermilion.
Sap Green.	Mineral Grey.
Emerald Green.	Royal Yellow.
Green Lakes 1, 2, 3, and 4.	Blue Cerulean.
Malachite Green.	French Ultramarine.
Indian Red.	Gamboge.
Light Red.	Oxide of Chromium.
Venetian Red.	Mars Yellow.
Red Lead.	Strontian Yellow.
Bone Brown.	Indian Yellow.
Cappah Brown.	Lemon Yellow.
Vandyke Brown.	Cobalt Blue.
Pale Naples Yellow.	Scarlet Vermilion.
Deep Naples Yellow.	Madder Brown.
Extra deep Naples Yellow.	Mars Orange.
Patent Yellow.	Sepia.
Chromes Nos. 1, 2, 3, and 4.	Pink Madder.
Raw Umber.	Madder Lake.
Burnt Umber.	Rose Madder.
Mineral Green.	Veronese Green.
Mummy.	Carmine.
Bitumen.	Violet Carmine.
Asphaltum.	Cadmium Yellow.
Dutch Pink (yellow).	Madder.
Brown Pink.	Madder Carmine.
Italian Pink.	Aureolin.
Neutral Tint.	Mygulph (Mastic).
	Mygulph (Copal).
	Sarum or Dryers.

PLOUGHED AND TONGUED JOINTS.

A THIRD FORM OF JOINTING UP.

BY DAVID ADAMSON.

HAVING given a description of the two most usual and useful forms of jointing up boards, as promised in the preceding chapter of this short series, the ploughed and tongued joint may now be briefly considered. It is probably the strongest of the three, but as the dowelled joint is sufficient for ordinary purposes, and is more easily made, tongueing is comparatively seldom resorted to in cabinet work. The reader will please note that only jointing up in order to get required width is referred to. Still, there are occasions when it may be more appropriate than either of the others, as, for example, with pitch pine boards, and if only for the sake of letting the novice know of its existence it must be mentioned. As may almost be inferred from its name, a groove is cut or ploughed along the edge of one or both of the planks to be joined, and the space so made is filled by a thin strip of wood. If both planks have been ploughed this strip is separately made, and half its width inserted in each. When, however, only one has been prepared this way, the other is planed down to leave a projecting ridge, which fits in the ploughed groove. It is almost needless to say that the former is the stronger of the two, and that it is the one almost invariably used in the finest work, *i.e.*, of course, when tongueing is preferred to dowelling. For amateurs, especially, it will be preferable, as only one plane, beyond the ordinary smoothing planes, is required; while in the other form a pair, one for cutting the grooves and the other for the tongue, will be necessary. Let us take the best form first, and see how it may be made properly and efficiently. The edges must be shot perfectly true as for a plain joint, for this is a *sine quâ non* in joints of all kinds. The plane, *i.e.*, the "plough" plane, must then be set so that the iron cuts the groove about the middle of the edge of the plank. I presume it is not necessary to describe here how the plane is to be set, as those who possess a plough will have no difficulty in understanding how to regulate the fence, which, by being pressed or kept in contact with the surface of the wood, causes the iron to cut in the same straight line. It will thus be seen that in working a plough two pressures, as they may be described, are required, one of them downwards and the other sideways during the whole of the forward thrust. One caution may save the novice the annoyance of being taught by experience, to wit, that if the iron is not set to cut exactly in the centre of the wood, the groove must be run equally on both pieces, the distance from the face being taken, with due regard to the grooves corresponding when the edges are brought together. A little thought will show the necessity for this caution, which, having been given, may seem a slight on the novice's common sense; otherwise, were he to make a mistake, for his consolation it may be stated that it would not be the first of the kind. The work with the plough having been completed, the boards are ready for tongueing. That this part of the work may be done in two ways—one of them being wrong, or, if that is too strong an assertion, without much stability in the joint, and the other correct, both theoretically and practically—may seem a superfluous observation. It would be were it not that the weaker method is sometimes practised by those who ought to know better, and the

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novice especially is warned against it. As has been stated, the tongueing is a strip of wood glued in both the ploughed grooves. Now, if this strip is cut so that the grain is coincident with that of the boards to be connected by it, it is evident that the strength cannot be so great as if the grain were at right angles with that of the board. In other words, the grain of the tongueing must be end on to the bottom of the grooves. This is the key to the proper way of making the tongued and grooved joint, about which, that there may be no possibility of a mistake, Fig. 1 is given, clearly showing the direction of the grain in the tongueing and in the boards to be joined. Possibly the novice may be told by some practical workers that the way the tongueing is done is not of much consequence, and that the insistence on one being better than the other is all moonshine. If so, hear his reasons, for a practical worker's reasons, when he has any and does not work only by routine, are always worth listening to by beginners, even though one may not at once see their force. If the argument in favour of this method of working seems sound, by all means try it, and don't dispose of it simply because some one else has told you that the work must be done in such and such a manner. I merely tell you what I consider the best method, and if there is a better way of getting at the desired result do not hesitate to adopt it. "Prove all things; hold fast to what is good," and always be on the look-out for better methods of work. Finality has hardly been reached yet in joinery, and, so long as new and improved tools and appliances are brought out, never will be. But, perhaps, it may seem much easier to plane up a length of tongueing with the grain than across it. It is; in fact, it would be absurd to expect to plane up a long cross-grain piece. Don't see it? Well, supposing a 6-ft., or even 3-ft., length of tongueing is wanted, where, in the first place, will a board sufficiently wide to get this off it be got in a general way? Boards of this width are not often met with. If they were, any hints on jointing up would scarcely be necessary, for the simple reason that none of this kind of work would be required in cabinet making. Of course, a moment's reflection will show that there is no occasion whatever for the tongueing being all in one piece, so that all that it is necessary to do is to cut pieces of the required width and thickness from the end of any boards. This piece of wood from which the tongueing is got will be prepared by planing before the pieces are cut off, so that the necessity for the awkward job of getting them to the right thickness is afterwards done away with. When prepared, the tongueings are to be fixed in with glue and the boards cramped together; but after what has been said about this part of the operation in connection with dowelling, no further directions can be needed.

But, it may be asked, are these the only methods of jointing up which are employed in carpentering? If so, a wide field is opened up for joinery or carpenters' work, which includes many branches, each having special modes of working. The one with which we have been concerned in these articles relates to the cabinet making only. Were it not so, other forms of jointing might have been mentioned, but the three, viz., plain, dowelled, and tongued joints, which have been dealt with, are those principally in use in all kinds of joinery. Those, therefore, who want to joint up for almost any purpose will know what to do, and, in conclusion, it is hoped that these few hints may have given the novice an insight into operations which can hardly be described in detail, while directions for making up a particular piece of work are being given. In succeeding articles various other joints, including dovetailing, will be explained.

A WHOLE-PLATE CAMERA:

HOW TO MAKE IT.

BY AN OLD HAND.

PHOTOGRAPHY in the present day has become one, if not *the* most popular of our art sciences, affording, as it does, healthy exercise both for mind and body, and opportunity for cultivating those artistic and æsthetic tastes that are innate in most of us. Opportunity is also provided for those of a mechanical bias, for exercising their talents of constructiveness, to aid which will be the special purpose of the following articles. If the instructions given are carefully followed and intelligently worked out, the amateur will not only be able to take a photograph, but have the additional satisfaction of knowing his pictures are veritably his own work, *ab initio*. In the next few papers we propose to put before the reader diagrams of all the necessary apparatus for making a photographic print, with plain instructions for their construction. The article of the first importance is the camera, or camera box as our Transatlantic friends put it, which is in reality a small portable dark chamber, at one end of which is fixed the lens and at the other the sensitive plate. This simple dark box has from time to time been added to and improved, till, from the crude apparatus of its inventor—Baptista Porta—in the second half of the sixteenth century, it has become the elaborate and ingenious contrivance of the present day. It goes without saying that all wood used in the construction of the camera must be of the best quality, and thoroughly well seasoned; the manufacture of this instrument being very high class cabinet work, all the precautions and devices used in cabinet work come into play. In making the camera, wood of close fine grain is to be selected. Mahogany, both Spanish and Honduras, has long been the favourite. Spanish is much heavier and harder than Honduras, and, having a fine grain, is generally preferred for *studio* cameras; but for outdoor work, where weight is a great consideration, the Honduras kind answers every purpose on this account, and being easier to work, it is better for the amateur to use. Very serviceable instruments have been made of teak. Ottewill, an early maker of cameras, used it freely for large-sized apparatus, and I can bear witness they will stand an immense amount of hard work with impunity.

Many other materials have been pressed into service, inclusive of paper, ebonite, and metals, the primary object being to have a tough, rigid, and light material, impervious both to moisture and light.

The camera of which Fig. 1 is a drawing has been selected as comprising all the necessary qualities, with as simple a form as at present devised. It was first introduced by Mr. G. Hare in this special design, but numbers of makers, appreciating the advantages of the pattern, have adopted it, preserving the principle but modifying the form. It will be noticed that the back is made to swing from the bottom, a plan to which some take exception, preferring the centre as the fulcrum; but for all practical purposes it answers very well, and is very convenient in use. A corresponding strut on the opposite side of the camera to that shown keeps the whole firm, the inclination of the back being secured by aid of the milled head screw nut, A, the screw itself being attached to the strip of metal, F, which works on a pin on the side of the baseboard, B. The bellows, C, extends to about 23 in., and closes up to about 3½ in., making it suitable for either long or short focus lenses. In place of the usual plan of raising or lowering the lens, a revolving disc is fitted to the front, working in a rebate, and kept from falling outwards by four small metal plates. The milled head attached to a pinion is for the purpose of shortening or lengthening the bellows. Fig. 2 shows the camera closed for carriage.

We will now proceed to construct a camera, having a supply of well seasoned ½ in. and ¼ in. mahogany. Begin with the baseboard, which it is necessary to make firm and strong, not only as a platform on which to build the body of the camera, but as that part by which it is attached to the tripod, and, of course, subject to greater strain than the rest of it. In the drawing given, Fig. 1A, the baseboard is carefully framed and clamped, in order to prevent the slightest warping, which would seriously interfere with the working of the sliding frame, which regulates the length to which it can be drawn out. In cheap, common cameras the baseboard is merely made of the right dimensions and clamped at each end. Fig. 1A shows the underside of the baseboard, with the framing and small brass screws, about 1 in. apart, which attach the strips shown in diagram Fig. 4, that form guides for the sliding frame, Fig. 2A. The dimensions being given with the diagrams, it is scarcely worth while to repeat them here. Fig. 2A represents the sliding frame, on the upper side, the inside edges of which are bevelled for appearance' sake. Two brass strips, B B, ½ in. wide and $\frac{1}{16}$ in. thick, are screwed to the frame along each outer edge, projecting ⅛ of an inch, and act as runners, so that the racking in or out of the bellows may be smooth and even. The ends of the strips near the hinges, C C, are slightly rounded, and small pieces more of the same are continued over the ends of the hinged bar, D. Fig. 3 shows the underside of the sliding frame and the two brass racks, A A, that when put in place engage with the pinion, F, in Fig. 4, actuated by the milled head at the side, Fig. 4, G. The screw plates, H H, are for the purpose of attaching the camera to the stand; the reason of two being made is that a better balance is obtained by using either one or the other, as the camera is used with long or short extension. Fig. 6 shows the side view of the sliding frame, with the curved joint, to permit easy folding of baseboard when closing the camera, X. The kind of hinge used, Fig. 7, represents the back frame of the camera, A, a metal plate with a slot in the centre, in which a pin attached to the brass strut, Fig. 7A, works. The notch, B, is useful to indicate when the back is a true right angle to the baseboard. The pin resting in this shows that the plate-holder is in its proper place. When a swing back is not required, it saves a considerable amount of trouble in adjustment. The frame, E, Fig. 7, is for the purpose of getting true register with the focussing screen and dark slide; it is sunk a ¼ of an inch below the outside frame, and has strips of black velvet glued on its face. Two small brass plates, C C, retain the slide and framing screen in close

contact at the lower part, and two hinged catches, D D, at the top do the same for the upper part, and merely have to be turned back to remove or replace the frames. F F are small notches cut in the frame, bound with brass plates, for use when the dividing screen, Fig. 11, is required. This consists of two strips of wood, B B; on one side of each is a strip of brass, A A, projecting a quarter of an inch beyond the wood, to do duty as buttons. These are connected together by a screen, folded zigzag, made of two thicknesses of black calico, with a core of brown paper pasted together. D D D D are elastic cords on each side of the folds to keep them from bulging when not stretched to their full extent. Fig. 8 is the reversing frame, one of the most useful modern additions, permitting an oblong plate to be used either lengthways or upright without altering the camera. It consists of a light frame made of $\frac{1}{4}$ in. wood, to which the focussing screen is attached by folding hinges. The usual plan is to have the hinges

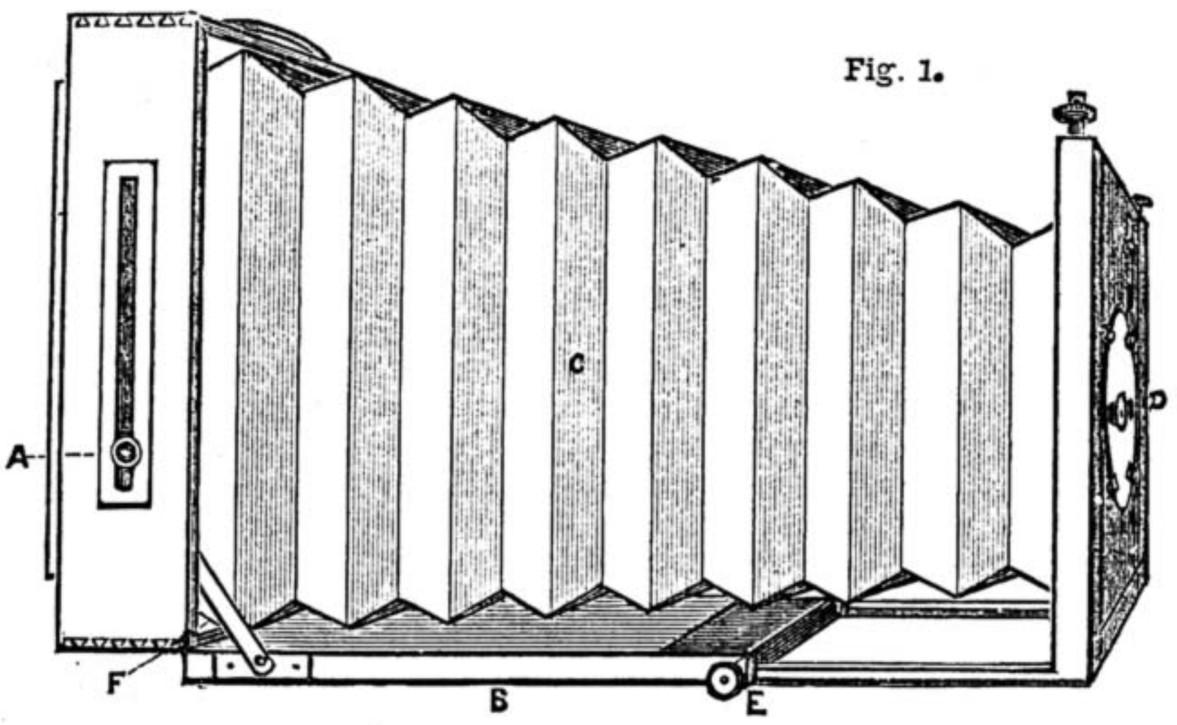

Fig. 1.

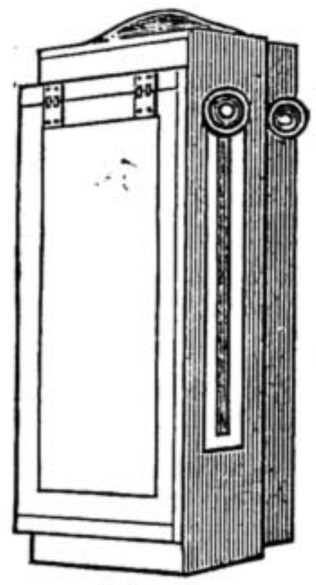

Fig. 2.

behind the plates, C C, in Fig. 7. Fig. 10 shows the front of the camera. The frame, C C C, is made of $\frac{1}{2}$ in. wood, E E being $\frac{3}{8}$ in. Two pins, B B B, pass down a groove in the back of the uprights, C C; a small plate attached to the end of the pin fits into the groove formed by brass strips at the bottom, and is pinched tightly by the nut, F. E E is the front, in which a circular hole has been cut with a rebate, in which works the flanged disc, A, Fig. 10. For convenience the rebate may be formed by building up the front of two thicknesses of $\frac{1}{4}$ in. wood,

the plate; also, by using a lens in one of the side apertures, a quarter turn will raise or lower the lens at will, or if the front containing the disc is made to work in grooves in the uprights, C C, a slot and F, a screw, will permit the front to be raised without altering the central lens. Of course caps must be provided for all the lenses, those not in use to be kept covered. The bellows, Fig. 12, is made of leather, over which black lining has been pasted. Each fold is $1\frac{1}{4}$ in. deep. There should be only one corner to join; an inch extra in the width will provide for the overlap. In making the bellows, a piece of leather of sufficient size, or as many as may be necessary, should be pasted firmly down on to the black lining. Cut to shape, then with a chalk pencil rule lines $1\frac{1}{4}$ in. apart across it from end to end; also draw lines from corner to corner, making allowance for the overlap; damp the leathers and fold them fanwise, and well press, so that the creases remain. Let them get

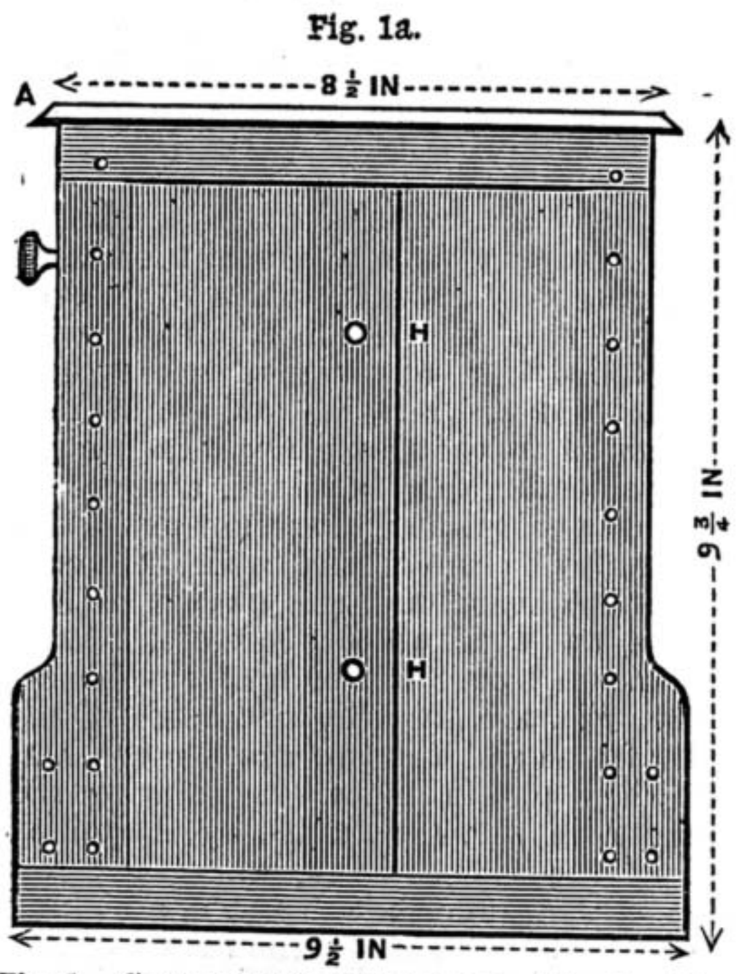

Fig. 1a.

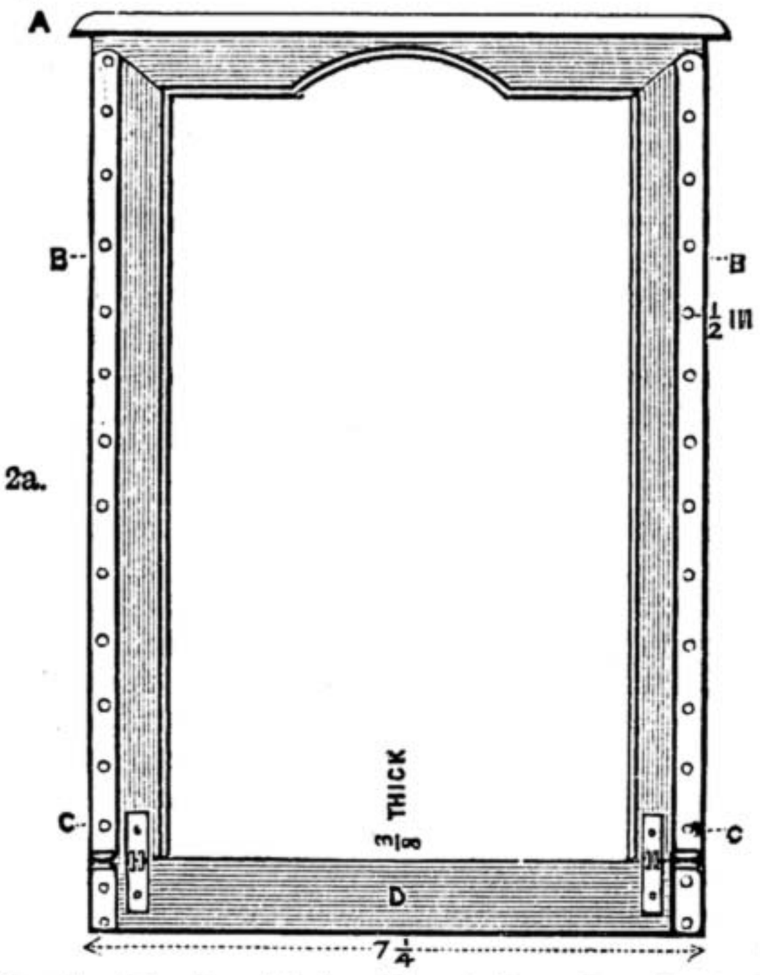

Fig. 2a.

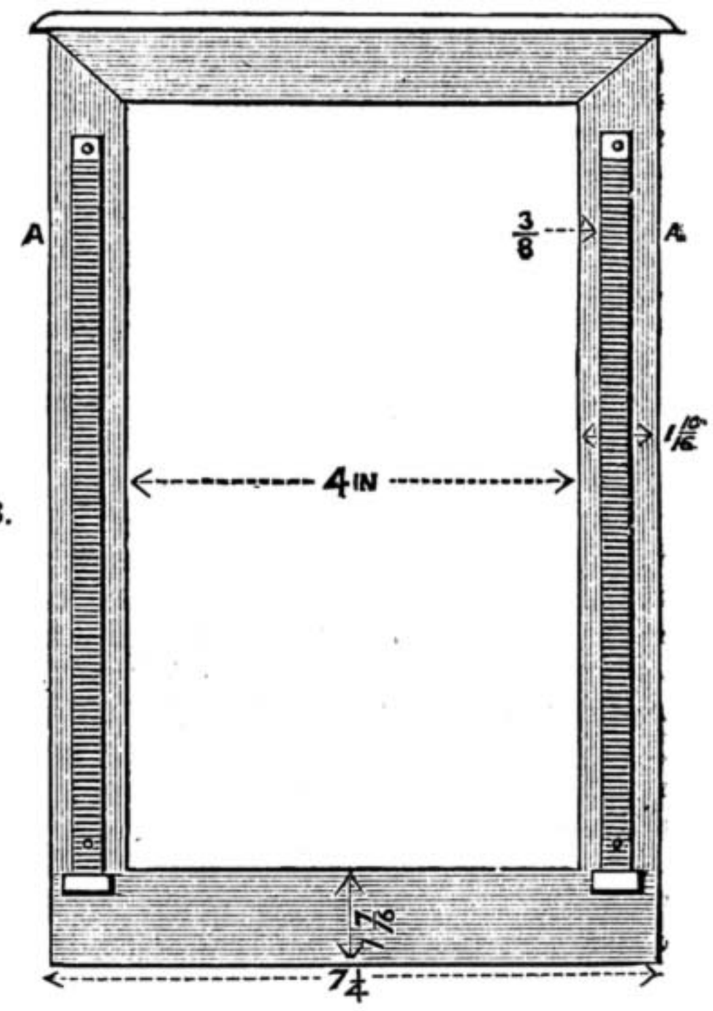

Fig. 3.

Fig. 1.—Camera Complete: Open. Fig. 2.—Camera Closed. Fig. 1a.—Underside of Base Board: A, Cap to Sliding Frame. Fig. 2a.—Sliding Frame of Base Board: Upper Side—A, Cap. Fig. 3.—Underside of Sliding Frame.

Inscription to Figures in page 361.

Fig. 4.—Upper Side of Base Board: A, Section of Base Board. Fig. 5.—Side of Base Board. Fig. 6.—Side of Sliding Frame: Width of Rod $\frac{5}{16}$ in. Fig. 7.—Back Frame of Camera. Fig. 7a.—Brass Strut. Fig. 8.—Reversing Frame and Focussing Screen. Fig. 9.—Side View of Reversing Frame. Fig. 10.—Front of Camera. Fig. 11.—Dividing Screen. Fig. 12.—Camera Bellows Extended. Fig. 13.—Dark Slide. Fig. 14.—Side of Slide. Fig. 15.—Cap of Frame. Fig. 16.—Section of Frame. Fig. 17.—Section of Top Frame of Slide. Fig. 18.—Shutter. Fig. 19.—Fire Screen. N.B.—Measurements in Diagrams are given for Whole-Plate Camera. To make Quarter-Plate Camera take one-fourth of Principal Measurements given.

at the top, and lift up the screen to insert the dark slides; but I prefer to reverse this, and have the hinges at the bottom; the focussing glass is more out of the way than with the other arrangement. The position is, however, optional. C C are small brass strips to retain the focussing glass, B, in its place; a shred of cork is placed between the strips and glass to prevent movement. The folding hinges, A A, by projecting a little over the glass, answer the same purpose on the opposite side. Fig. 9 is a side view of the reversing and focussing frame; the projecting fillet, B, is for the purpose of making the frame light-tight. C C, the part of the frame that fits in the circular hole in the inner one being a little smaller than the outer. E E is lined at the back with $\frac{1}{4}$ in. wood; a smaller aperture in it than in the front piece forms the rebate, and covers the groove cut in C C, boxing in the pins, B B, and to which the narrow ends of the bellows are fastened with strips of wood, glue, and a few small screws. The bellows, Fig. 12, are fastened to the inside of the frame, Fig. 7, in the same manner, as near to the front as possible. The disc, A, Fig. 10, is provided with apertures for three lenses. This gives an opportunity for using two small lenses for stereo or lantern pictures, or a larger one for the whole size of nearly dry under pressure, then fold on the lines drawn from corner to corner and diagonals, the leather being outwards; bend them into the proper shape, glue the overlap edge, and put under pressure, folded until dry. It is now ready to be attached to the frame of the camera. All the woodwork of the inside of the camera blackened with lampblack ground up in *thin* shellac varnish, all the visible outside parts nicely French-polished, and the camera is completed. One other important matter is the dark slide, Fig. 13. To make a good folding dark slide almost more skill is required than for any part of the camera

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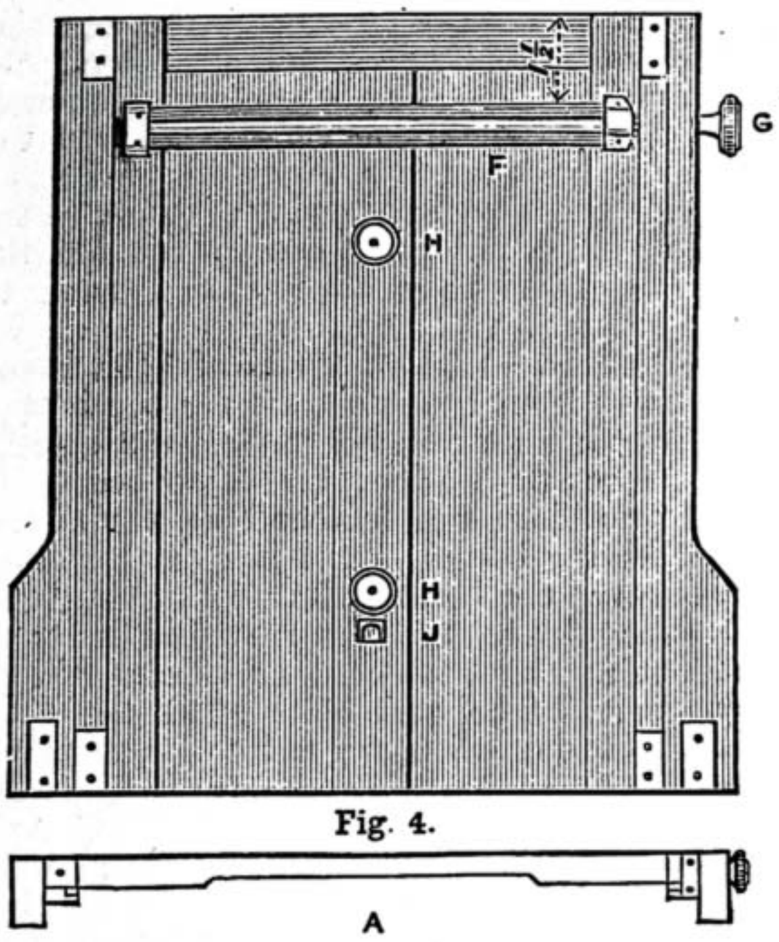


Fig. 4.

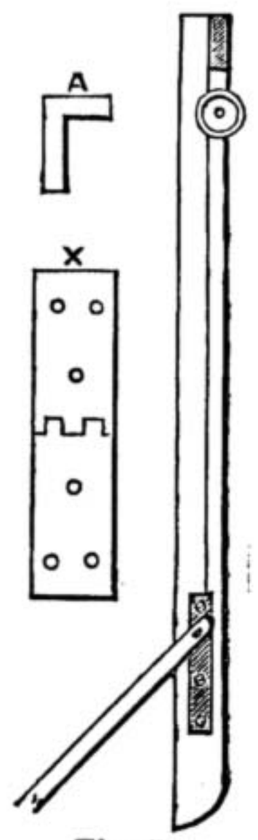


Fig. 5.

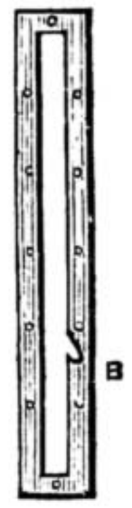


Fig. 6.

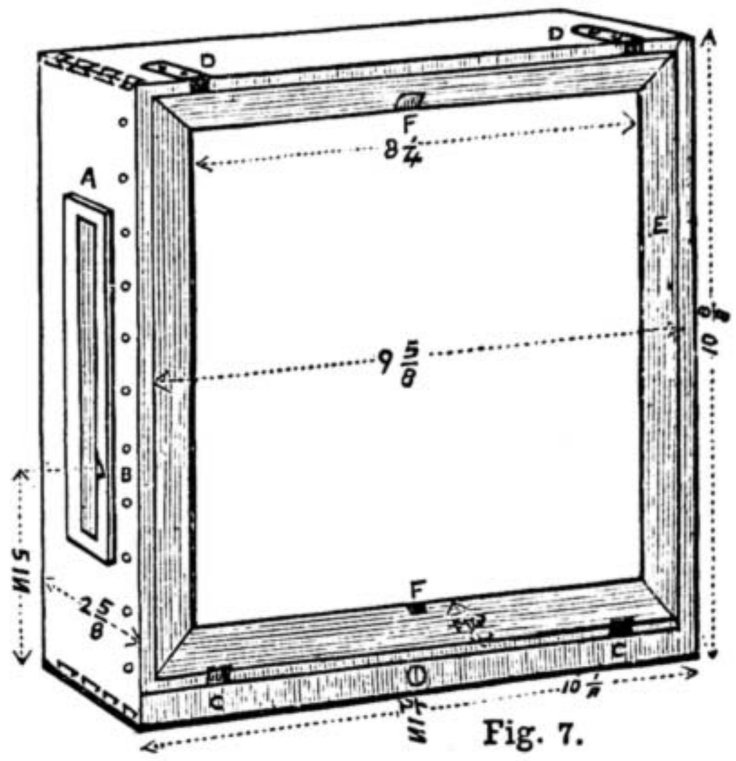


Fig. 7.

Fig. 7a.

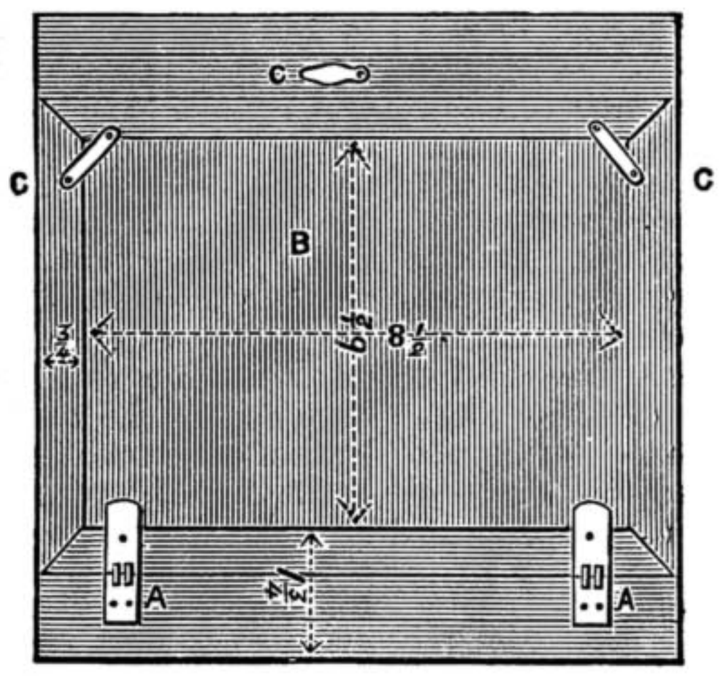


Fig. 8.

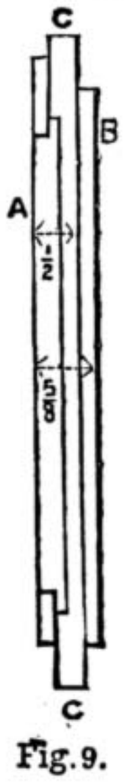
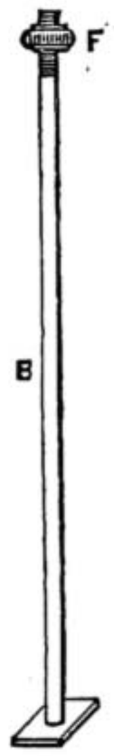


Fig. 9.



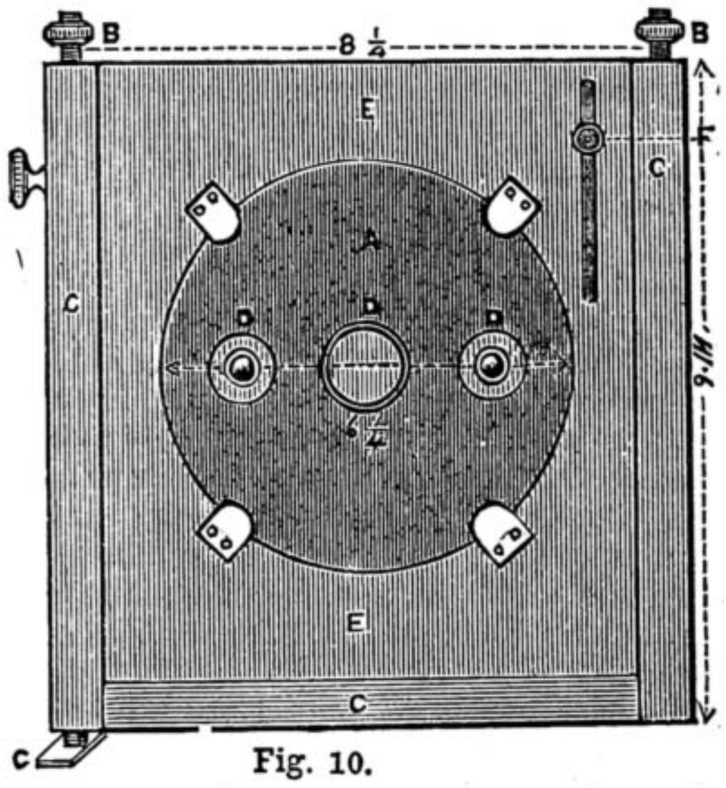


Fig. 10.

Fig. 13.

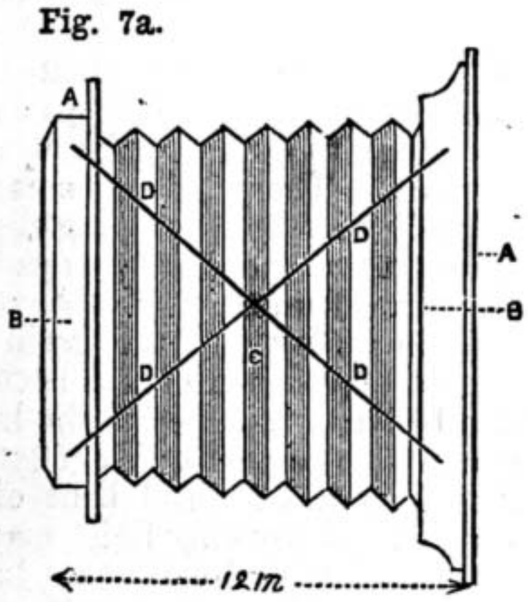


Fig. 11.

Fig. 12.

Fig. 14.

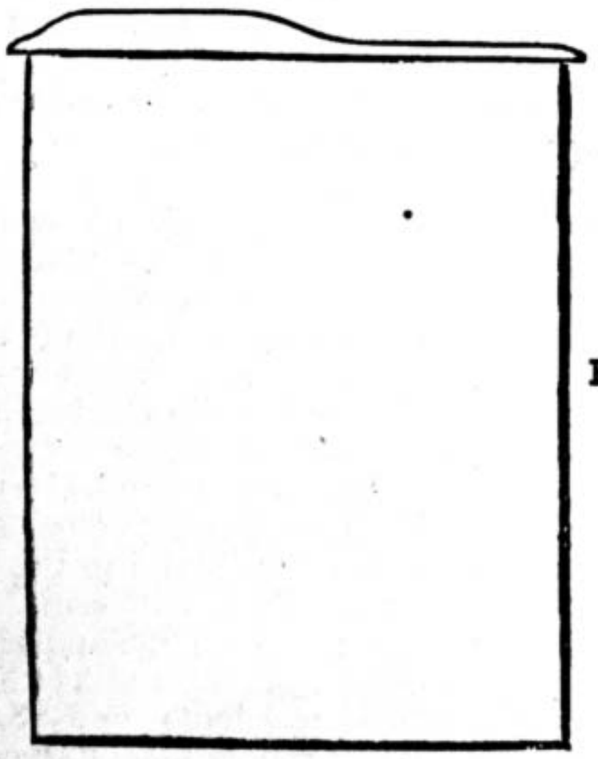


Fig. 18.

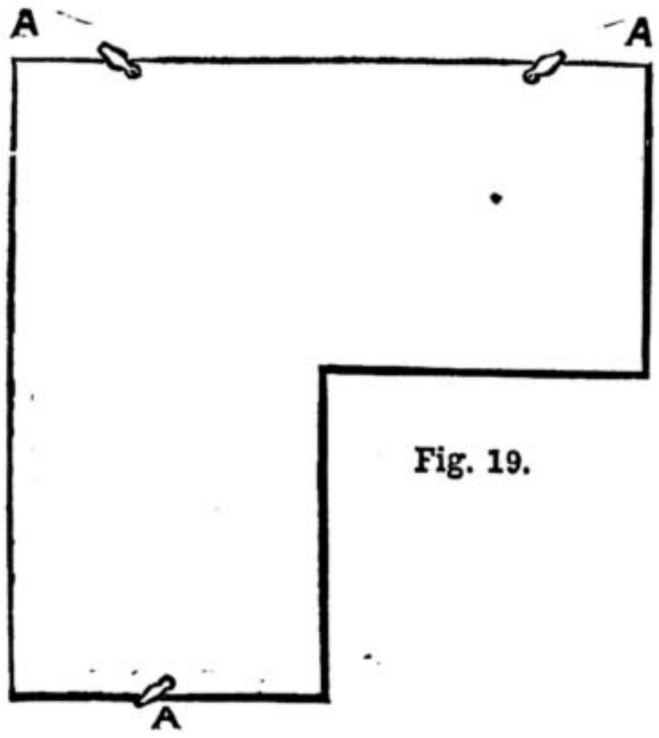


Fig. 19.

Fig. 15.

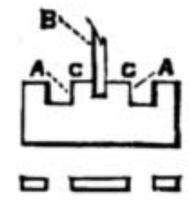


Fig. 16.

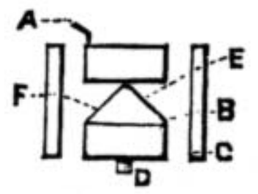


Fig 17.

For Inscriptions to Cuts above, see page 360.

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proper; but as the American pattern answers equally well, and is much more easily made, we have selected this as a model, and, personally, prefer it, as being less liable to admit light than where hinges have to be dealt with, or cause imperfections on the plates by the materials used for the hinges—a very common complaint. Fig. 13 represents one of this class of slide. It consists of a frame made of $\frac{1}{2}$ in. wood, B B B, containing two grooves, as shown in section Fig. 16, very carefully mitred at the corners. Fig. 14 will show a side view of the same. The groove at the bottom, Y, is $\frac{1}{4}$ in. wide, leaving two flanges $\frac{1}{8}$ in. each, which will take the position of the focussing screen when in use. Fig. 16 shows a section of the slide; A A are grooves $\frac{1}{12}$th of an inch wide, in which the shutters work, Fig. 13, E. Fig. 15 shows the cap of the frame outside; Fig. 17 a section of the same. It will be seen to be constructed of several pieces, a truer fit being obtained in this way; and it is of vital importance that no light should find entrance. Just below the central bar are two light strips of wood, Fig. 17, E, attached with a strip of any flexible material to the bar above; a small bent wire, F, is passed through the top of the strips, projecting slightly on one side into the groove. The effect of this is, when a shutter is withdrawn, the spring of the wire causes the strip of wood to bar the passage of light from the empty groove, and when it is returned, and the other shutters withdrawn, it closes that side in its turn, thus making an efficient light trap. Inside the grooves, A A, a strip of velvet should be glued, as a further protection from adventitious light. A small L-shaped piece of stout wire, with a thread on one end, should be screwed into the middle bar, Fig. 15, at C, to turn over the end of the caps of the shutters, to prevent them being inadvertently drawn out. A division of wood, Fig. 16, B, $\frac{1}{8}$ in. thick, isolates the plates from each other, on which are glued strips of wood $\frac{1}{10}$ in. thick, whereon are fastened two small brass buttons, C C, Fig. 13. Two small pins at the bottom, close to the edge of the shutter groove, D D, provide for the plate being in proper register. The shutter itself may be made of three thicknesses of veneer, one laid opposite way of the grain and sandwiched between the other two to prevent warping, glued and dried under pressure with a capping of wood, as in Fig. 18. The projecting part of the cap is to permit the withdrawal of one shutter without interfering with the other, and is arranged as in Fig. 13. Ebonite may be substituted for veneer, but is rather heavier. The ends of the cap project slightly, in order to cover the groove into which they slide. The measurements given are for a whole-plate camera, as being the most useful of any size. By means of a screen, Fig. 19, made of thin zinc blackened, and one-fourth removed, with small buttons, A, fastened in front of the frame of Fig. 7, any quarter of the plate can be exposed without interfering with the rest. This is useful for lantern slides. To make a quarter-plate camera of this pattern, it is sufficient if the *principal* measurements are one-fourth of those given. Lighter brass work may be used, but $\frac{1}{4}$ in. wood is sufficiently thin. The circular front is not required, the screw and slot movement being better for raising the front, if a rising front is thought desirable.

In my next paper I shall give an account of the method of making a Tripod Stand, and Stand for Camera in Studio.

BEAKERS, BELL METAL, AND BELTS.

BY GEORGE EDWINSON BONNEY.

BEAKERS—BEER—BEESWAX—BELL METAL BELTS —BENZINE.

Beakers.—These are tumblers made of very thin Bohemian glass for special use in the laboratory, where small quantities of acids and other liquids are employed at high temperatures. Tumblers made of ordinary glass would soon break in pieces, but these thin glass beakers will bear boiling water being poured into them, or will hold acid whilst it is being boiled in them over a gas stove. They are also useful in analysis of solutions, as the clear glass enables the operation of precipitation to be observed whilst the operator holds the beaker away from his face, and thus enables him to avoid breathing the deleterious fumes. Glass beakers are also easily cleaned by rinsing them in clean water. If discoloured, the stains can generally be removed with dilute nitric or hydrochloric acids, or with liquid ammonia. They should always be cleaned and rinsed with clean water after each operation or experiment, and placed upside down on a shelf to drain dry. They are made in sizes to hold from 1 to 40 or more fluid ounces.

Beer.—Stale beer is used as a lubricant for scratch-brushes whilst scratch-brushing electro-plated or electro-gilt articles. Unless this, or a similar lubricant is used, the brass of the brush wire gets worn off as fine dust and becomes embedded in the surface of the plated article, rendering it more or less brassy in appearance. A tea made of marsh mallows, and also weak linseed tea has been recommended to those who may object to the use of stale beer.

Beeswax.—This substance, collected by common bees from flowers, is found to be an excellent material for making moulds on which to electro-deposit copper for electrotypes. Mr. A. Watt says of it: "This is a very useful material for moulding, and may be applied either in the form of virgin or white wax, or the ordinary commercial article—yellow beeswax." Since this substance, however, is very commonly adulterated, it may be useful to know something of its natural characteristics. At the temperature of 32° Fahr. beeswax becomes brittle, at from 80° to 90° it becomes soft and plastic, and it melts at about 155° Fahr. Mr. B. S. Proctor says: "It becomes plastic or kneadable at about 85° Fahr., and its behaviour while worked between the finger and thumb is characteristic. A piece the size of a pea being worked in the hand until tough with the warmth, then placed upon the thumb and forcibly stroked down with the forefinger, curls up, following the finger, and is marked by it with longitudinal streaks." Its ordinary adulterants are resin, farina, mutton suet, and stearine; though more ponderous substances, such as plaster of Paris, have sometimes been detected. White wax is very commonly adulterated with spermaceti, sometimes to the extent of two-thirds of the latter to one of wax. These sophistications, although not necessarily fatal to the preparation of good moulds, are certainly objectionable, inasmuch as it not unfrequently happpens that a wax mould splits or cracks, not alone from cooling too quickly, but owing to the presence of foreign substances which impair its toughness.

Bell Metal.—The bell metal used in gongs is composed of four parts copper to one of tin. This alloy, when first cast, is very brittle, but the casting can be annealed by heating to redness and quenching in cold water. The gong, when turned to form, may then be again heated and allowed to cool slowly, when it recovers its tone and elasticity. Gongs to be plated should be treated as brass, but must not be roughly thrown about, as they are brittle enough to be broken by a sharp blow.

Belts.—Various kinds of belts have been used from time to time for the purpose of driving machinery, but all must yield the palm to leather, for there seems to be "nothing like leather" as a material for driving-belts. As it is most important to have the best belts for driving dynamo machinery, the plater should know something about the choice and care of driving-belts. The best belts of all those I have had to do with are made of raw hide, with seamless joints, manufactured by an American firm, and sold by Messrs, T. C. Andrews and Co., 137, Commercial Street, London, E. The joints are made by cementing the long champfered edges of the leather together under pressure. These are sometimes made stronger with a flat leather lace embedded in the leather. The joints are so neatly made as to present no additional thickness, and very little difference in suppleness, from any other part of the belt. The leather is sent out oiled ready for use, and, therefore the belts will retain their suppleness for many years whilst working in ordinary temperatures. Oiled belts take a better grip on the pulleys than dry belts, and, therefore, need not be run so tight as the latter. This lessens the strain on the grain of the leather and conduces to the long life of the belt. Dry belts are apt to slip on the pulley, and the friction on the leather, caused by slipping, causes it to heat and thus "burns the life" out of the belt. Belts should always present a clammy side to the pulley. In dry situations, such as in an engine-room or hot workshop, the clammy state of the belt should be kept up by giving it a dressing of dubbing and a coat or two of boiled linseed oil at least once a year. Always choose a belt wide enough to do the work without undue tightness. There is economy in using moderately wide belts running slightly slack, as against narrow ones put on as tight as they will bear. Run the flesh side of the leather next the pulley, and the grain side outside, because experience of the both has shown that a belt run this way lasts longer than one run with the grain side next the pulley. It is also the natural bent of the leather. Small belts working light machinery run fairly well with butt joints linked with double tee brass links (Green's patent belt fasteners) inserted in the leather, but these are apt to tear out if the belt has to do heavy work. These joints have the advantage of being easily and quickly made. Sewn lap joints should be used for heavy driving-belts. Laced lap joints with the laps well thinned down and the laceholes punched in diamond-shaped rows do fairly well. All lumps accumulating on the pulleys or the inside faces of the belts should be promptly removed as soon as discovered, as they overstrain the belt and cause jerks in the machinery.

Benzine.—Chemical symbol C_6H_6. This is a thin, limpid, colourless liquid, of agreeable odour found in the light oils obtained by distillation of coal. It boils at a temperature of 176°, and solidifies to a white crystalline mass at 32° Fahr. It is used to free woodcuts and copper plates from printer's ink before they can be copied by the electrotype process.

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OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

77.—THE "JOHN BULL" POCKET GAUGE.

The handy little waistcoat pocket companion which is distinguished by the appellation of "John Bull" Pocket Gauge presents a number of useful features which should commend it to most, if not all, wood and metal workers, and especially to engineers and machinists. It is said to be "the cheapest, best, and most useful ever offered to the trade, serving three times the purposes of any other." That it serves a multiplicity of purposes may be seen by inspection of the annexed illustration, which clearly shows its form and the various purposes to which it may be put. Its price is 2s. 9d., and on receipt of this amount it will be sent post free to any address in the United Kingdom by the manufacturer, Mr. George H. Bruce, mechanician, 10, Helena Street, Smethwick, near Birmingham. It may be useful to our professional readers to add that agents are wanted everywhere for its introduction and sale, and that for terms of agency a stamp should be sent to Mr. Bruce. It is claimed that it can be used as a rule, a straightedge, a centre gauge, two screw-cutting tool gauges, two squares (inside and outside), two hexagons (inside and outside), and five useful drill and wire gauges. It can further be utilised for setting the tools for screw cutting, and as an angle gauge for grinding the points of drills. The drill and wire gauges, as will be seen from Fig. 1, provide for diameters of $\frac{1}{8}$ in., $\frac{5}{32}$ in., $\frac{3}{16}$ in., $\frac{2}{32}$ in., and $\frac{1}{4}$ in. Its utility as a rule, however, is not sufficiently indicated in the illustration, for in the subdivisions of the 2-in. measure, engraved on its lower member, thirty-seconds, sixteenths, eighths, quarters, and halves of inches are shown, whereas on the gauge itself, sixty-fourths of an inch are indicated as well. As a gauge for squares and hexagons, it may be as well to point out that the angle, A B C, affords the gauge for the outside of a hexagon, and the angle, B C D, for the inside hexagon, or rather for a hexagonal hole cut in any material. In like manner, C D E forms the test or gauge for an inside square, and D E F for an outside square. As a straightedge, the bottom of the appliance or edge just below the graduated 2 in. measure is used. The centre gauge and gauges for screw-cutting will be found in the angular indentations on the right and left hand of the drawing. The gauges are made of fine steel, the greatest care being used in their manufacture, and every gauge sent out is guaranteed to be true. They are, at the same time, strong and durable, although light and small, and they have been introduced by the maker to supply the want of such an appliance that has been long felt in every branch of mechanical inquiry.

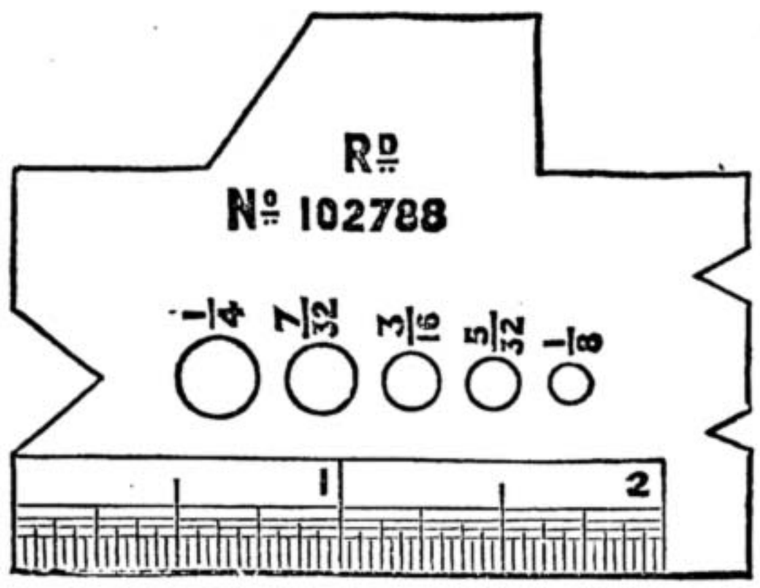

Fig. 1.—The "John Bull" Pocket Gauge.

78.—PATENT POTATO RAISER.

The Patent Potato Raiser, manufactured by Messrs. Powell Brothers and Whitaker, Wrexham, appears to be a very valuable addition to the agricultural machinery now in use in this country, and although it has not been long in the market it is certainly highly appreciated by farmers who have used it, as affording the means of lifting potatoes from the soil at from one-half to three-fifths the cost incurred by the usual mode of raising the roots by forks, while the potatoes are all cleared and thrown on the surface of the ground without injury in the form of bruises and cuts often caused by bringing the points of the fork into violent contact with them. It may be said that it gained the first prize of the Royal Agricultural Society of England, awarded at Newcastle, October 4th, 1887, when exhibited in competition with other machines of the same class, exhibited by leading manufacturers; the gold medal awarded at the Wirral and Birkenhead Agricultural Show, September 14th and 15th, 1887; and four silver medals in 1888, at the meetings of the Shropshire Agricultural Society, the Cheshire Agricultural Society, the Manchester, Liverpool, and North Lancashire Agricultural Society, and the Altrincham Agricultural Society.

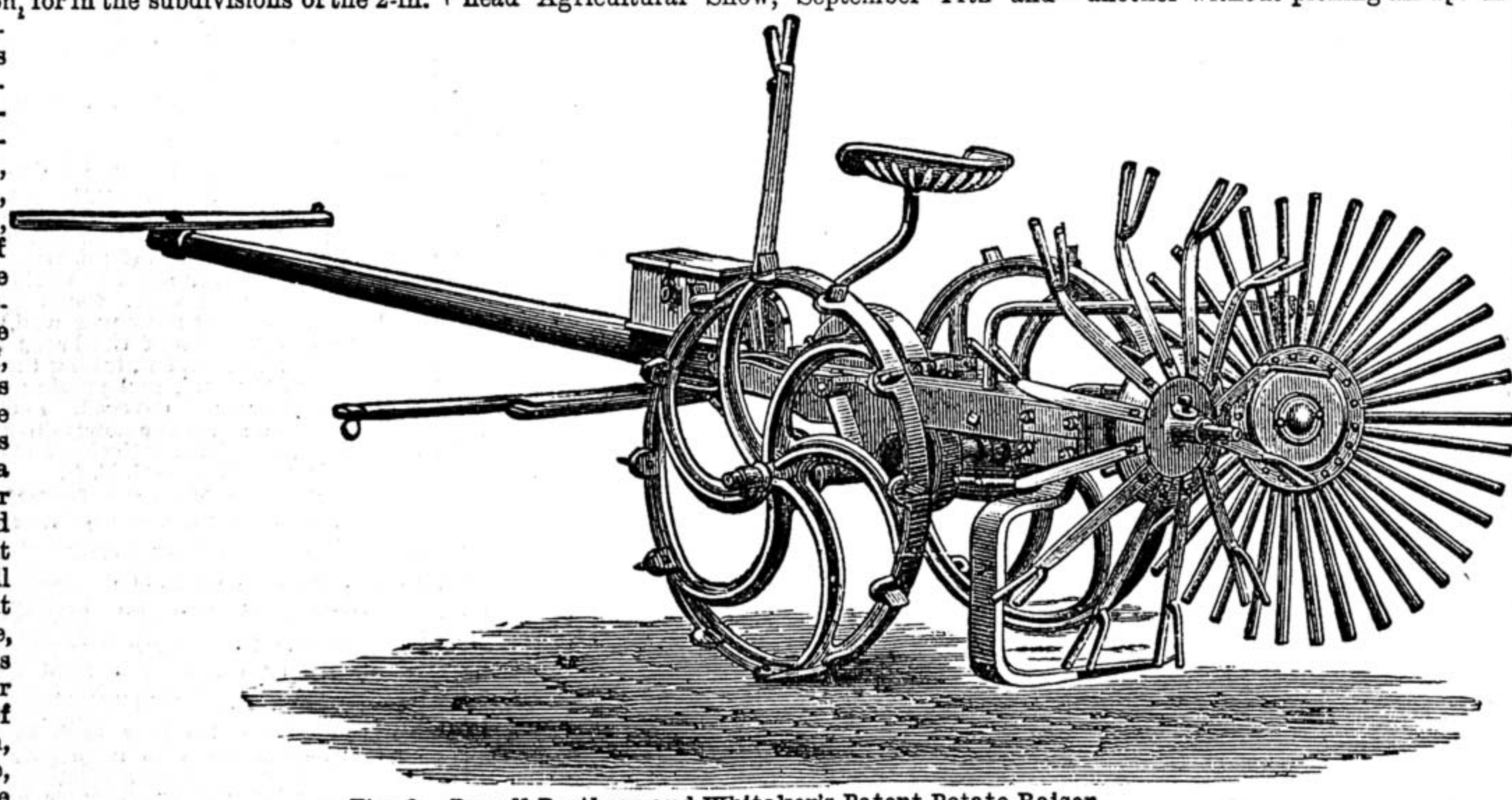

Fig. 2.—Powell Brothers and Whitaker's Patent Potato Raiser.

The form and nature of the machine and the mode in which it operates is sufficiently shown in the accompanying illustration (Fig. 2), in which the only thing to which I can take exception is that the seat occupied by the driver apparently proceeds from the left-hand driving wheel, one of those accidents that will sometimes occur in engravings of machinery, but which, in the present case, can be very easily altered in the wood block.

The main part of the machine consists of a heavy strongly-constructed central frame or body, to which all other parts of the machine are attached, from the bars to which the horses that draw it are yoked to the fork wheel and accompanying gear in the rear. Below the body is the axle, on which the driving wheels with their broad tires and projecting points are set, being self-cleansing and adjustable on the axle, so as to suit the width of the ridges, which, as a matter of course, is not in all cases the same. The fork wheel, by which the potatoes are raised from the soil and which enters the soil transversely to the length of the furrow, is flatly conical in shape, so as to admit of the forks being set on it at an angle, thus leaving more soil behind the machine to work with less power than when spread with an ordinary straight wheel, and is less liable to cover the potatoes. It is constructed to work with six, eight, or twelve forks, and is adjustable forwards or back, for heavy or light soil. To the right of the Patent Digger is a revolving wheel or cratch, which turns the potatoes back when thrown against it, thus preventing them from spreading too far, allowing the soil to fall through first, and entirely protecting them against being covered with dust or light earth. This cratch is turned by the force of the soil thrown against it from the fork wheel, which saves the potatoes from being bruised.

The gearing, as the makers explain, is entirely enclosed, and is of improved construction. The speed is gained by spur and bevel wheels, so that the fork spindle is raised above the main axle to give the fork wheel the proper angle, and allows of a large bevel pinion wheel to be keyed firmly on the spindle. The bevel wheel has a bearing on each side, which ensures an easy and perfect running gearing. It is fitted with a pole which entirely prevents the machine from running askew and cutting through the potatoes on one side of the ridge. It is claimed that it is the only machine that can dig one ridge after another without picking all up. A seat, to which I have already alluded, is attached to the pole so that the driver can regulate the depth of the share whilst at work, and to lift it clear from any obstruction without a second lever. It is provided with a simple arrangement to throw it in or out of gear. The machine, it is said, is shorter than any other, can draw out on an ordinary headland, and can raise from three to four acres of potatoes per day. It is made of the best material throughout, and the bearings are fitted with brass bushes and oil cups. Lastly, the share is screwed firmly to the frame, and is without any joint to work loose. The cost of the machine is soon saved on a large farm by the reduction of expenses incurred in raising the tubers by hand.

Whether or no it will ever become popular among English agriculturists remains to be seen; but there is much in it to recommend it to notice.

THE EDITOR.

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SHOP:

A Corner for Those who Want to Talk It.

*** Notice to Correspondents.—*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Artistic Domestic Metal Work. — Fitter (*Huddersfield*) writes:—"Would you be so kind as to let me say a few words in 'Shop?' I have taken all the numbers of Work, and I am well pleased with it, for it is a great blessing to such as me, and I hope it will long live to do its duty to working men in England and elsewhere, as I am sure it will do, if working men will only appreciate it. Will some reader of Work be so kind as to give a few papers on making what I call artistic domestic metal work, both for ornament and use. I mean such things as fireirons, fenders, coal-boxes, ribs, kettle stands, iron stands, and toasting machines for toasting bread without holding it in the hand. I have a toasting machine which I have made, and if it will be of any use to you I will give you a description of it. It sold for 6s. at a bazaar, so you may guess it is not a plaything. I cannot make a good drawing of it, but I will do the best I can, as I am not a draughtsman."—[Working men, I am glad to say, do appreciate Work. There are a few who practically tell me that they could manage and edit it far better than I do, but when I remember that there are those who think they could have fought Waterloo much more judiciously than F.M. the Duke of Wellington, and could have knocked Napoleon into a cocked hat into less than half the time the Duke took over it, I rest content under the animadversions on my own shortcomings. You appreciate Work at precisely its right value. It is not intended absolutely to teach a workman his trade, but to help him to a better comprehension and appreciation of the work he is doing daily. The young workman and the apprentice cannot fail to learn much from it, and all, whether skilled or unskilled, will be helped to the adoption of a hobby, in the prosecution of which he will certainly find amusement and recreation, and perhaps profit as well, in the approaching future; for I have known many a man begin with the practice of an art or craft as a hobby, and end by becoming a proficient in it, and making a good living out of it. By all means send the description and sketch of your toasting machine. Work is essentially a working man's paper, and as a working man myself—I may say a hard working man—I wish the thoughts of working men, whether on paper or in the more tangible form of things made and done, to find a place in Work. I am in thorough sympathy with working men, and I covet nothing better than to be in thorough touch with them.—Ed.]

II.—Questions Answered by Editor and Staff.

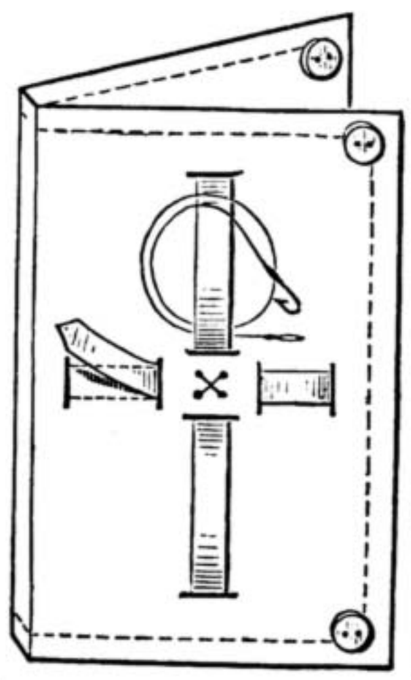
Greenhouse Sashes.—Signalman (*Southport*).—The best way to find the *exact* sizes of the sashes required for the greenhouse is to erect the framing first and get the sizes from the openings, as any variations in the scantlings of the wood used in the framing will cause an appreciable difference. If, however, the wood is of the sizes given in the description then the sizes of the four side sashes would be—height 3 ft. 8 in., length, 5 ft. 7 in.; the two sashes for the closed end are the same height, and are 3 ft. 7 in. wide; those for the door end are 2 ft. 6 in. If the roof is made as shown in Fig. 9, the sashes are each 5 ft. 10 in. long, and 6 ft. 2 in. wide. The length of the end rafters is 5 ft. 9 in. To get the level of the lower ends draw a square, then draw a line diagonally across it from corner to corner. This gives you the level, which is the angle of 45 degs.; the top ends are square, and dovetailed as described. As to the size of the glass, I would divide the side and roof sashes into five panes, those of the closed end into three, and the door end into two panes respectively. As to the making of the sashes and door, they are mortised and tenoned in the usual manner, detailed instructions for which would occupy several papers. As to the kind of glass, 15 oz. sheet would be sufficient unless you are liable to have heavy hailstorms in your locality, when that in the roof could be 21 oz. The sizes of the triangular sashes in the ends of the house you had better get after the framing is put together. You can then, having got the exact sizes, either draw them down full size on a board, or make a thin wooden mould to fit the openings, from which you can work. All the sashes, with the exception of those of the roof, should be made ¼ in. less than the given sizes. This will save trouble in fitting them, and facilitate their easy removal when taking the house down.—G. L. B.

Stencils.—G. S. (*West Ham*) means the stencil plates used for marking sacks, hop pockets, and such things. I can inform him that I used to cut a great many of them for farmers and hop dealers, and the only tools I used were as follows:—A smooth cast iron plate 12 in. square or larger, a light hammer, three chisels, ⅛ in., 1/16 in., and ¼ in. in width; a 6 in. half-round file, a 6 in. flat file, and a 4 in. or 5 in. square file. I mark out my letters, taking care to mark the ties that are to be left in; then chop them out, using the narrow chisels for the curves, and the wide for straight lines. I then rap down the burr with a mallet, and file up. The stencils such as used by decorators, &c., are very much thinner, and can be easily cut with a knife. Any ordinary sharp-pointed knife will do, but one with a fixed handle is preferable. Lay the plate on a piece of smooth, hard wood or plate glass; cut slowly, and frequently sharpen your knife. G. S. will see by this that there is no need for any special tools, and anything mentioned here can be got or made at any tool shop, and the price is a mere trifle.—R. A.

Designing.—E. S.—An architect may be a designer, but it by no means follows that designers are architects. You say you are a cabinet maker, serving your time at the trade, and that your "fancy is a little inclined towards designing furniture." Before you can design, you should be able to draw correctly and with ease, and to this end you should attend the school in your neighbourhood where evening lessons are given in drawing. and study to pass the South Kensington examinations and gain your certificates for freehand drawing. geometry, etc. etc. It will be useful to you to obtain and study a work recently published in two volumes, 6s. each, by Messrs. Cassell & Company, Limited, entitled "Hand and Eye Training." In this work it is sought to encourage the faculty of designing in a student from the time that he begins to learn drawing.

Picture Frame Making.—A. E. H. (*Bermondsey*).—No trade will be forgotten or neglected, and picture-frame making will receive treatment in due course. I know that many, like yourself, wish Work to be made twice or three times its present size, and sold at 2d. or 3d.; but such a step would only tend to diminish its large circulation, and therefore its utility and influence.

Tackle Book for Anglers.—Piscator.—Papers will certainly be given on the manufacture of fishing tackle and gear of all kinds. Some, I think I may say, are already in preparation, but this is all I can tell you at present. You say:—"Will you kindly tell me how to make a good tackle book for anglers?" The angler fishes for the most part with a bait impaled on a hook, worms and maggots of various kinds being used for ground fish, and fern webs and bluebottle flies in "dapping" for trout. You must of necessity carry your bait in a tin box or a bottle, and it is for the gut and hooks that you really require the tackle book. I am not a fisherman myself, for I have seldom time for anything else but work and Work, but I think I can put you in the way of turning out a good home-made tackle book. First get an old pocket book, not too small, and carefully cut away the contents; this will give you a cover with a pocket on each side, which will be useful for many purposes, and the stowage of hooks, cleft shot, swivels, etc. For the leaves get some parchment—old deeds, etc., come handy for this sort of thing—and cut pieces a little smaller than the cover when fully opened, but enough to fold into two leaves, with a back as shown in annexed illustration, about ¼ in. wide. There must be two of these pieces for each pair of leaves. Sew or stitch them neatly a little within the edge, with coloured, black, or white silk, so that the leaves are double. Then cut eight narrow slits through each leaf, as shown, and through the four central slits pass slips of cardboard, or some tougher material, if possible, as drawn, and secure them in the centre by stitching. The ends of slips must be cut to a point, so that each end may be easily passed under the parchment through the slit opposite to that from which it has issued. One slip is shown outside the slit in the illustration to show my meaning clearly. When a slip is released it can be passed through a coil of gut with hooks attached, and then put again through the slit from which it has been withdrawn. A small disc of cork, rather less than ⅛ in. in thickness, should be sewn to the outer corners of each leaf to keep the leaves fairly apart. The leaves should then be sewn into the pocket-book cover along each crease that has been folded to form the back.



Celluloid.—J. P. (*Glasgow*).—The British Xylonite Company, Limited, 124, High Street, Homerton, London, E., are makers of this.—P. W. S.

Safes and Safe Doors. — F. G. (*Brighton*). — Thanks for the extract you forwarded.—Ed.

Designs of Drawings.—G. C. (*Drayton Park*).—By all means let me see the designs you wish to submit.—Ed.

Glass Printing.—C. D. (*Bethnal Green*).—You cannot patent an idea; but you can patent a process or a machine required to carry one out. You should in your case consult a patent agent.—F. C.

Shell Rabbit. — A. S. (*Euston Road*). — The specimens of shell rabbit that you send have been recently offered for sale in the streets of London at 1d. each, and are curious from their marked resemblance at a little distance to the animal they are intended to imitate. The shell forms the body of the whelk, cleansed, probably by the application of a little hydrochloric acid. The head and fore feet—there is no tail other than that supplied by the lower end of the shell—are made, I should say, of putty, to which white lead has been added in order to make it harden quickly. The material is applied to the point of the shell, and moulded to the shape of a rabbit's head by the fingers, for on one side of the head of one of the specimens sent you can see distinctly the impression left by the ridge-and-furrow skin of the thumb. If you look at the inner side of the top joint of your own thumb you will see what I mean. The ears are first pinched up into one long point, which is divided by a knife, the blade being turned first one way and then the other to make the ears slope outwards. This, as far as I can determine, covers the manufacture of the shell rabbit in every particular. The fore feet are merely two little dabs of the same material rounded off in front; they serve to keep the shell steady, and prevent it from rolling about.

Burnishers for Brass.—A. R. (*Edinburgh*).—A file with the teeth ground out and polished makes as good a burnisher as anything, or good tool steel will answer the purpose equally well. Beer is a good liquor, or water with a little vinegar.—J.

Papier-Mâché.—R. W. (*Manchester*) omits to name the precise purpose for which he wishes to prepare his papier-mâché, which makes it less easy to advise with precision. There are various ways in which paper may be made to resist water and insects. Pasted papier-mâché can, of course, be made bent to any angle. The thorough saturation with linseed oil which it undergoes gives it great water-resisting power, and various coatings may be given it—the solution of gutta-percha in naphtha with a little shellac, recently recommended to Bofin (page 301), would be a good one. Or, a mixture of paper dust and black japan might be made, which would have the desired qualities, and might be bent whilst yet soft. With regard to procuring papier-mâché pulp in large quantities, R. W. is referred to Messrs. McCallum & Hodgson, Summer Row, Birmingham.—S. W.

Wood Carving in the Round.—Mac O'Roney (*Nairn*). — Plaster casts will be found the most available patterns from which to carve in the round, as practice for a beginner; and these are to be bought in most towns, though perhaps the largest and best stock in Great Britain is at Brucchiani's, Russell Street, Covent Garden, London. But M. O'R. is strongly advised to practice modelling in clay as a means of making prints and photographs available for his purpose, and still more as a means of embodying any designs of his own, which he may wish eventually to carve in wood. He will shortly be able to learn all about modelling from Work.—M. M.

Coating Bare Places in Covered Wire.—V. R. (*Liverpool*). — The bare places in your 24 silk-covered wire may be coated with india-rubber cement; but I should prefer covering them with silk. Get some soft silk (floss, tram, or woven silk will be best), never mind the colour, providing it will lie close to the wire. (Sewing silk is too hard and wiry, and will not cover well.) Fix the wire firmly on both sides of the bared spot, and then wind the silk around it, taking the thread of silk direct from the reel, and passing this round and round the wire until covered. Then rub a piece of paraffin wax all over the newly-covered spot for the double purpose of fixing the loose ends, and making sure of the insulation.—G. E. B.

Batteries for Electric Lighting.—New Beginner (*Manchester*).—Very little in the way of electric lighting can be done by means of primary batteries — that is, electric batteries which have to be charged with acid to produce a current of electricity. The lamp and battery you saw in a shop at Manchester was, probably, a four-cell chromic acid battery supplying current to a five-candle power lamp. The light from this when compared with that from a No. 3 gas burner, or the light of a shilling paraffin lamp, is a mere glimmer. You would require four such lamps to light a moderate-sized room in a private house. Such lamps do fairly well as attractive advertisements for shop windows, or glimmer lamps for small rooms on summer evenings. It will take at least 5-quart Bunsen cells to properly light up a 5 c.p. lamp, and the cells will require fresh charges of acid every nine or ten hours. I will try to go thoroughly into this subject soon, and give the results to the readers of Work in a separate article.—G. E. B.

Tinning Iron Wire.—H. G. (*Liverpool*).—The proper way to secure an even coating of tin is by drawing the wire as it comes from the tinning bath through a burnished steel die fixed near the bath, and kept warm by an atmospheric gas jet burning beneath it. The die being exactly gauged so that the wire only just passes through, insures an even coating, and being burnished gives it a polish. The winding arrangement should be far enough away to allow the wire to cool after leaving the die, the hole in the dye is rounded off so as not to

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cut the wire. I expect that H. G. would hardly think it worth his while to go to the expense of a steel die, so I will first suggest something that I think will answer very well, at any rate far better than the corks. Take a 1 in. gas socket and two plugs for same; drill a hole through each side of the socket, say ⅜ of an inch diameter, or larger, file off the rough burr on the inside, and trim up the outside a bit smooth, in case the wire should rub against it; screw one of the plugs into the socket, about two threads only, then hold the socket in a vice by means of the square on the plug, and pack it tightly with good tow or finely dressed hemp. When packed as tight as you can get it, screw in the other plug a few threads, and the bottom one a little more, then draw your wire through this instead of the corks. You might use two of these arrangements, if so, I should grease all the packing of the first one with tallow. I think this plan will answer every purpose, and shall be glad to know if it is of service to you.—P.S. The top plug is to adjust the pressure on the packing, as you find it necessary.—L. L.

Printing.—T. S. B. (*Shrewsbury*).—Blanket, fine cloth, linen, thin oilcloth, glazed board, or paper, may be used for covering the cylinder of a printing machine, and each possesses advantages (or disadvantages) according to the materials to be dealt with and the quality of work to be produced. For rough work, newspapers or broadsides, or where the type is old, it is advisable to use a blanket; but if good work is required, the harder the cylinder is packed the better will be the effect, in the hands of a skilled workman.—J. F. W.

Laying on Picture Frame Gold.—JUMBO (*York*).—Proceed as in answer to B. N. (see page 333), and when thoroughly dry with a camel hair brush, apply good mastic varnish with care, that no dust gets upon it during drying; probably cost 7s. 6d., if you do not waste the gold, and you have all the tools.—G. R.

Gladstone Bags.—JUMBO (*York*).—I have done the same myself, and found best Berlin black evenly laid on with a good painter's sash tool renovate them well; but if you also give it a couple of coats of French polish, and good vegetable black well mixed, this answers admirably.—G. R.

Book-case.—ALPHA AND P. M. M. (*Epsom*).—You will have noticed that a good form of book-case was given in No. 15, page 231. Others will follow.

Index to WORK.—P. M. M. (*Epsom*).—Indexes will be furnished for WORK. I agree with you when you say:—"I think no one intending to buy the Magazine would object to pay for an index if you thought well to issue one."

Photographic Exposure Tables.—W. P. J. (*Aberystwith*).—I shall be very happy to see your tables, as of course till I have had an opportunity of testing them no definite opinion can be expressed. Glad to hear you like WORK.

Bookcases.—S. A. (*Homerton*).—In No. 15 of WORK you will find some instructions on bookshelves, which will, no doubt, be useful to you. An article in the artistic furniture series of papers will also shortly appear, describing the construction of a bookcase. As the design for this is for an "enclosed bookcase"—*i.e.*, one with cupboards, it is probably just what you want.—D. A.

Bureau Bedstead.—H. G.—An article describing and illustrating the construction of a cupboard bedstead, will appear very shortly. You will find it very useful.—D. A.

Stand for Overmantel.—C. S. (*Brighton*).—The overmantel, when supported in the way you propose for yours, will virtually form the back or upper portion of a cabinet. An article descriptive of a cabinet is in the list of subjects to be treated in the series "Artistic Furniture," of which the overmantel was the first. Thanks for good wishes.—D. A.

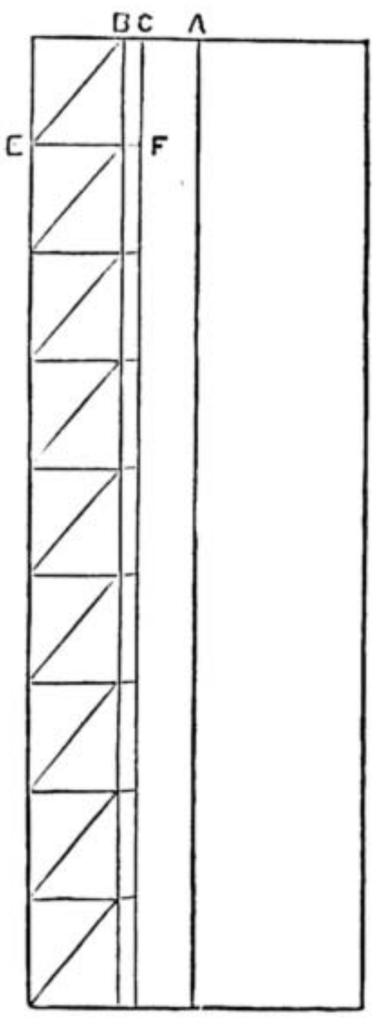
Model Beam Engine.—A. Y. (*Leeds*).—As your engine is only 2 in. stroke by 1½ in. bore, I should not advise you to try to make it condensing. You might do so no doubt, but a little engine of this size ought to run fast, and pumps will not work well unless they go slowly. A turbine runs fast because the water runs through continuously; but in an ordinary pump the water has to be set in motion and brought to rest at every stroke. Take a glass syringe, and, putting the spout in water, draw up the plunger suddenly. You will see the water does not follow immediately, but seems to think about it, and then comes unwillingly, only half filling the barrel. Draw up slowly, and you get the barrel full. Draw up suddenly, and as suddenly press down the piston, and you get no water at all, because the piston comes down before the water has had time to move. You will gain no power by adding a condenser to such a little thing, because all the power gained by the vacuum will be expended in working the air-pump. If you must have a working model condensing engine, have a cylinder 4 in. by 2 in., use a fly-wheel of large diameter, and don't let it run over about sixty revolutions per minute. You could probably make your engine of type metal. I have seen one made so, but I would not expend trouble on such material. I strongly advise you to make a high pressure engine first, of a useful size, and leave the condenser for the present.—F. A. M.

Bamboo Furniture.—E. L. (*Portland Place*).—Yes, articles on this interesting subject have been arranged for, and will appear in due course. Mr. Fred] Westbury, 183, Great Dover Street, holds the largest and best stock of bamboos suitable for your purpose. You can obtain any quantity from him, but of course you cannot expect wholesale prices for small quantities. Owing to the enormous circulation of WORK, we go to press very nearly three weeks before publication.—D. A.

Work Bench.—D. B. (*Perth*).—Yes, the subject will be treated, and in due course. I hope to place before readers of WORK designs and instructions for making a bench, both to contain tools and work at. Meanwhile, it may interest you to know that an article describing the construction of a small folding bench is in hand. Your scoldings for destroying the kitchen table may speedily be stopped by your putting a board on top of it, in other words, have a wood cover, and work on it.—D. A.

Polishing Bookcase.—AMATEUR (*Openshaw*).—You will find it easy to stain your bookcase a mahogany colour; but being inexperienced in staining it is very doubtful if you would be able to match the colour to that of the existing furniture. If you are inclined to try you must first stain and then polish. I hardly think it would be worth your while to French polish, and probably you would get a better result by varnishing. Between staining and polishing or varnishing apply a coat of size. If you decide on French polishing proceed in the usual way.—D. A.

Step Flashing.—A. B. (*Barking*).—To set this out proceed as follows:—Cut your stuff the length required, the width will depend upon how much is to lap on the slates. See sketch, which shows the marking out of a piece 3 ft. long 12 in. wide; draw line, A, down the centre, draw a second line, B, 2½ in. from A, and a third line between the two ½ in. from B. Now obtain the bevel of the roof—that is, the angle formed by the two sides of the roof; take a rule and lay one arm edgeways on the slates, bend the other till it comes parallel with the joints in the brickwork. This will give you the bevel to mark off the flashing with. Before marking these, however, set off lines, E F, from the edge of the stuff to line C, 4 in. apart. The joints in brickwork are 3 in. from top of brick to top of brick; but the flashing laying in a slanting direction, requires to be marked an inch more—that is, supposing the roof is a square mitre, or 90 degrees of angle. Now lay the bevel on line B, and mark off the diagonal lines; now cut the straight lines as far as line C, and the diagonal ones only as far as B. This gives ½ an inch to turn back into the joints. I presume A. B. knows how to fix, and trust this will give him the information he wants. If not clear on the subject, write again.—R. A.



Mahogany Top.—T. R. H. (*Birmingham*).—No doubt the sweating, as it is technically called, of your table is owing to your having used too much oil. You seem to have saturated the wood with this. Only a small quantity of oil is required well rubbed in. In fact as you seem to have an idea that a large quantity is needed perhaps the best way of conveying to you what is wanted is to say that rubbing with an oiled rag is almost sufficient. This, you will see, is very different from a good coat of oil every night for a week, by which one may infer that the wood has been saturated. You must have misunderstood your French polishing friend, as no practical polisher would recommend such a procedure as you have adopted. All you can do now is to let the oil sweat out, and if you keep on rubbing with a dry rag daily you will soon have a good surface, which though not so brilliant as French polish will withstand heat from plates, dishes, etc. The more you rub the better the polish, and you will not require to use wax polish, as by the time your table is done it will be "oil" polished, and quite as brilliant as if you had used wax. Work is seldom oiled before waxing. A simple refrigerator will appear in "Shop" very shortly. Much obliged by your kindly remarks about the articles by OPIFEX, and your good wishes for WORK.—D. A.

Saw Belts Slipping.—"A READER" (*Skipton*).—As a temporary expedient, a little powdered resin will assist the adhesion of a belt. But belts are very apt to slip on circular saw pulleys, because the pulleys being small, the arc of the circle embraced by the belt is small. Hence they require frequent tightening. Do not let the belts become dry, but preserve their suppleness with castor oil. Belts inclined or horizontal drive better than vertical ones. Long belts drive better than short ones, and short ones require to be tighter than long ones. Short belts are a mistake. As a last resource, use a leather-covered pulley, or employ a binder or tightening pulley to the slack side of the belt.—J.

Dulcimer for Home Use.—"MUSICIAN" (*Dublin*).—An experienced hand is preparing an article on Dulcimers for the readers of WORK.

Dulcimer.—T. C. B. (*Birmingham*).—Kindly read the above, which answers the questions you are good enough to put.

Prints Transferred to Wood.—J. G. (*Manchester*).—Without precise knowledge of the nature of the process used to produce the prints you mention, I should say, as far as my experience of lithographic and copperplate printing goes, that it would be quite possible to print them upon wood from stone from transfers previously made from copper plates. The wood (sycamore or maple) having been procured of an even thinness throughout, and also planed very smoothly, the scraper of the lithographic press should be set to suit the substance of the wood, and in pulling the impression the putting down and lifting up of the lever should be carefully manipulated to obviate breaking the stone. Articles bearing views of the particular locality are best known at the more frequented seaside resorts, where they furnish an inducement for the unlucky visitor to part with his spare cash in the purchase of them as mementoes or presents for his womankind. Imitations also are sold, which are simply prints mounted upon wood and varnished, and for most purposes they are as good as the real thing. If you do not possess a lithographic press, perhaps you may appreciate the counterfeit as quite within the limit of your powers.—J. H. M.

Cylinder to Geneva Watch, etc.—WATCHMAKER (*Stoke*).—To put in a cylinder see instructions given to COUNTRY WATCHJOBBER, on page 302: tools required, a pair of turns, conical pivot file and burnisher, graver, and gauges, bow and ferrule, wax for ferrules, half resin and half beeswax. To solder, make a close fitting and clean joint, use very little solder, and use powdered borax for flux for all hard soldering joints; boil out or let it stand a time in a solution of sulphuric acid, 1 part to 19 parts of water, then polish off. To make silver solder, melt together 2 parts silver and 1 part brass wire; or a very easy-running solder, but not so strong, may be made from equal parts of silver and tin, melt the silver first. Gold solder, 18 carat gold, 12 parts; silver, 2 parts; brass wire, 1 part; for lower qualities of gold articles use the same standard as the article to be soldered, adding the same proportion of silver and brass. I should strongly recommend all watch and clock jobbers, professional or amateur, to get "Britten's Watch and Clock Maker's Handbook, Dictionary, and Guide," price 5s., containing 384 pages of useful matter relating to nearly everything in the trade, with a host of illustrations of tools, etc.—A. B. C.

Bookbinding.—J. T. H. (*Inverness*).—Papers on bookbinding in the orthodox way will appear shortly, and from these you will learn how to make the nice round back and straight edge that we see on all books, from the professional binder.

Wire-thread Fret Saw.—J. T. H. (*Inverness*).—I can only repeat that the wire-thread fret saw is not yet on sale in this country. As soon as it is so I shall be told of it, and will mention the fact in "Shop."

Bird Stuffing, etc.—W. T. (*Maybole*).—Taxidermy will not be forgotten, but I can say no more than this at present.

Kaleidoscope.—PICA (*Old Brompton*).—The first part of the description of the new kaleidoscope is in my hands, and will soon see the light.

Parkesine.—J. B. (*Oxon*).—Parkesine, xylonite, or celluloid are identical, and are made from nitrocellulose [$C_{12}H_{14}O_4(NO_3)_6$], more commonly known as pyroxiline or "gun cotton," which is cotton or other celluloid substance treated with nitro-sulphuric acid which renders it soluble in various chemical agents, such as alcohol and other hydrocarbons with or without camphor oils, and in some cases, gums and resins. This interesting substance was discovered by Mr. Alexander Parkes, of Birmingham, who, more than forty years ago, being impressed with the necessity for the introduction of a substance to take the place of certain natural productions, such as ivory, tortoiseshell, etc., set himself to discovery such a substitute, and with this end in view, made many thousands of experiments, till at length his ardent search was rewarded by the "epoch-making" discovery that by combining gun cotton with various other substances he could produce such an article as he had been so long in quest of. In 1855 Parkes took out the first patent, but being at that time engaged with the firm of Elkington, Mason, & Co., he was unable to give his unremitting attention to the subject, and so it was not till the London Exhibition of 1862 that he succeeded in gaining much attention to his product. Though the specimens there exhibited were made in a rough manner by himself without the suitable appliance used in the various trades, he received the silver medal. By the time, however, of the Paris Exhibition, 1867, the matter had made such progress that his exhibit was judged one of the most remarkable specialities shown. Up to this time no name had been given to the new product, and in honour of the invention one of the French papers called it "Parkesine." On his return the Parkesine Company, Limited, was formed, into

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which the inventor threw his patents and took common lot with the other shareholders. The speculation was not, however, a financial success; and its collapse left poor Parkes minus his outlay of money and his patent rights, and with nothing but the medals he had gained in London and Paris, and the satisfaction of knowing that he had been the discoverer of what is admittedly one of the most important substances applicable to the arts and manufactures ever discovered. A second company followed the first; and this latter was succeeded by the present British Xylonite Company in England, while the Celluloid Company flourishes in America. About ten years ago, Mr. Henry Parkes, who has been associated with his brother in most of the latter's inventions, took out some important patents, and founded at Birmingham the "British Celluloid Company," but I am not informed as to its success or otherwise. Of course, the details of the manufacture vary according to the purpose to which the product is to be applied, and by proper manipulation (mainly by variation of the solvent used and any amount of pressure applied) any required degree of hardness or flexibility can be secured. It can be made, for instance, as hard as ivory, or in so soft a condition as to be capable of being spread in layers over textile fabrics, much in the same way as paint is used. The product is waterproof, acid-proof, and airproof, and may be made, if not fire-proof, at least, non-inflammable. It can be worked in the liquid, plastic, or solid state. It can be pressed and stamped, planed, turned, sawn, carved, woven into fabrics, and, as first seen, applied as a varnish. It can be made transparent or opaque, and of any desired colour. I shall be glad to send any further information at my command on learning your precise requirements; but I have no doubt a letter addressed Messrs. Alexander and Henry Parkes, Inventors of Celluloid, Birmingham, would reach the inventor himself, who would be able to advise you fully.—R. W. S.

Enlarging Camera.—F. C. (*Trefechan*).—I do not know what process you refer to. There are many ways of making crayon enlargements, the easiest of which is to make an enlargement on bromide paper, and work it up with crayons. This process is mostly worked in black or sepia; but if you want to use coloured crayons, then you must develop the image faintly on the paper, so that the black tone may not spoil the colouring. Of course, it requires considerable artistic skill to work up a crayon enlargement and keep the likeness; and, unless you possess such skill, the result of your labours will be disappointment. If you care to try the experiment, you can make an enlargement on Eastman's A paper, develop well out, then soak in castor oil until quite transparent, and colour from behind as in crystoleum. Use oil colours. A very good effect can be got this way with care. The lens you mention would do quite as well for enlarging from ¼-plate negatives.—G. Le B.

Advertisement Pages.—GRAHAM (*Perth*).—Kindly see reply to AD FINEM, in No. 16, page 253.

Pump and Pressure Gauge for Model Engine.—W. N. (*Birmingham*).—If the boiler of your engine is only 7 in. long by 3 in. diameter, the feed pump will be very tiny, and will very likely cost you as much trouble as to make the whole engine. You might make it ½ in. diameter and ½ in. stroke. I once had one, that worked, of ¼ in. diameter and about ½ in. stroke. It is useless to "fiddle" over such a little thing, nevertheless I send a sketch of mine used with a 1-in. cylinder, 2-in. stroke. Fig. 1: A is the body, screwed and then

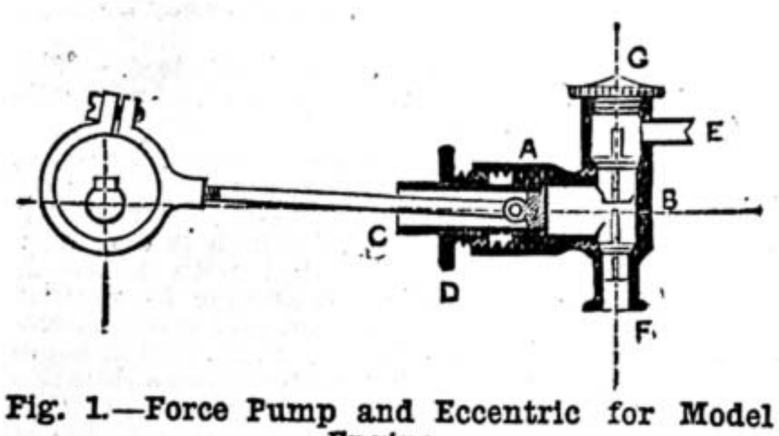

Fig. 1.—Force Pump and Eccentric for Model Engine.

soft soldered into B, the valve-box; C, the plunger, with an eye—the eccentric rod is first fitted, and then the eye is soldered in; D, the gland with milled rim, for screwing up with fingers; E, the delivery pipe, is also screwed and soldered in; F is the suction, and receives an india-rubber tube; G is the cap screwed down on a bit of soft thread: it also acts as a pet cock when slightly released to let out air. The valve-box is drilled first, with three sizes of drills, the middle size being not less than the diameter of plunger; then make the small valve on the end of a bit of brass rod, so that you can push it up the hole and grind it to its seat while the box is running in the lathe. The guide under the valve must fit the hole of F so as to keep it straight, and when ground, it is to be filed with three sides, to form passages for the water. Then turn the little stem above the valve and cut it off. Now fit the upper valve in the same way, making the guide come within 1/32 in. of the top of the lower valve, so as to limit its lift. It should lift about one-eighth its diameter. Similarly the cap screws down to within about 1/32 in. of the upper valve. The most important thing in these little pumps, as in large ones, is to leave no pocket for air inside. Put the delivery valve on the highest point, then the air will be driven out first. I have seen many sections of feed-pumps in different papers I feel convinced would give endless trouble, if they worked at all. When you have made this pump, make a 1½-in. cylinder-engine and apply it to that. It will keep it well supplied. You ask, secondly, how to make a steam gauge. Models of the size of yours are not usually furnished with one, and it would be difficult to make one small enough of the ordinary description, and if you could succeed it would probably be worth two or three times as much as the boiler! Fig. 2 shows a kind of steam gauge I made with some bits of ¼-in. glass tube, a very little mercury, and a bedroom candle, when a boy of seventeen. A, the tube, held in the candle and gradually bent as seen; the upper end was sealed with a blowpipe made with another bit of tube, partly closed by being held in the flame. The bent end is slightly enlarged to take a short length of india-rubber tubing, which will do to make the connection at low pressures, especially as you can easily renew it if it swells. B is a bit of board to which tube is wired, and on which divisions are marked. A very small quantity of mercury is introduced, as shown; by warming the tube and then holding the mouth in the mercury you can make it suck it in. When the mercury stands at a convenient height, C C, make the mark C on the board after first making sure the tube is cool; then mark at D the end of the hole in the tube. Now C represents atmospheric pressure, say 15 lbs. above vacuum. Halve C, D, and you get E, which will be 30 lbs. from vacuum, or 15 lbs. per square inch. Probably that is as much as your boiler should carry, but you can continue the subdivision, halving E, D at F, and marking there 30 lbs. above the atmosphere, etc., etc.—F. A. M.

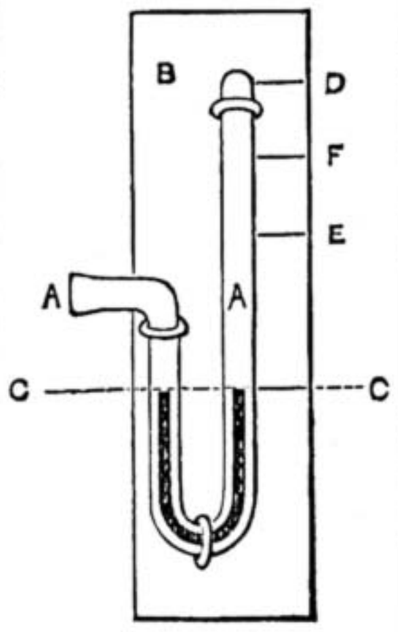

Fig. 2.—Mercurial Steam Gauge for Model Engine.

Damp Floor in Fowl House.—T. G. L.—Fowl houses will be dealt with if opportunity offers, and the subject is in demand. It is a difficult matter to determine, without seeing the place, why the floor of your house is always damp, although the roof is perfectly water-tight. Perhaps as good a plan as any to overcome this drawback would be to dig out the earth to the depth of 12 in. or 18 in., and fill up with brick-bats and coarse gravel, with fine gravel and cinder ashes on the top. This would afford means of drainage if the soil is naturally damp. Give your fowls plenty of old lime if you can get it. Calcined oyster shells, beaten to fragments, and sand, especially sea sand, are also useful.

Basket Making.—J. T. H. (*Inverness*).—Yes, instructions will be given on basket making; but I have not yet succeeded in getting hold of a literary basket maker who can write on his trade.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Insurance of Workman's Tools.—J. K. (*Oxford*) writes:—"I am writing to ask you whether you could tell me (a journeyman cabinet maker), or find out through WORK, if there is an insurance office anywhere to insure tools kept at a workshop. I have tried to insure my tools in other offices, but have failed. I hope this is not out of the range of your column for 'Shop.'"

Tools.—G. P. (*Edgeley*) writes:—"AN AMATEUR would be glad to be advised what tools (carpentering) to get to commence, so as not to get too many, nor go to great expense, and where best can be got at lowest cost—say, for building greenhouse, etc."

Moulders' Pattern Making Tools.—E. R. (*Halifax*) would be glad if some reader would, through the agency of your paper, WORK, give him a list of tools that are used, and the cost of each, in moulders' pattern making.

Walking Stick.—G. W. M. (*Westbourne Park*) writes:—"Can any reader of WORK give me the name of a London turner who would supply me with a lignum vitæ walking stick?"

Blue Prints.—PHOTO (*Chester*) writes:—"I have been much pleased with the instructions for preparing the sensitised paper for taking blue prints, and have succeeded in taking some fine copies. There is, I believe, a process for taking copies of engineering tracings, giving a black line on a white ground, the bath being gallic acid. Would any reader of WORK kindly give me the mixture and the proportion for preparing the sensitised paper for this process?"

Finishing Brass.—S. H. D. (*Newtown*) writes:—"Could any brother reader of this valuable paper inform me as to what method is pursued to put that finish on brasswork so that when it is handled it does not tarnish?"

Removing Ink Stains.—LITTLETON (*Worcester*) writes:—"Will a reader kindly say how best to remove ink stains?"

Trade Notes and Memoranda.

IN 1892—the anniversary of the discovery of America—the United States will hold a World's Exhibition. Workers should prepare.

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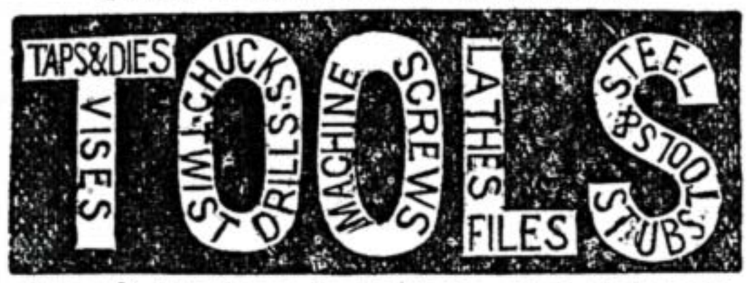

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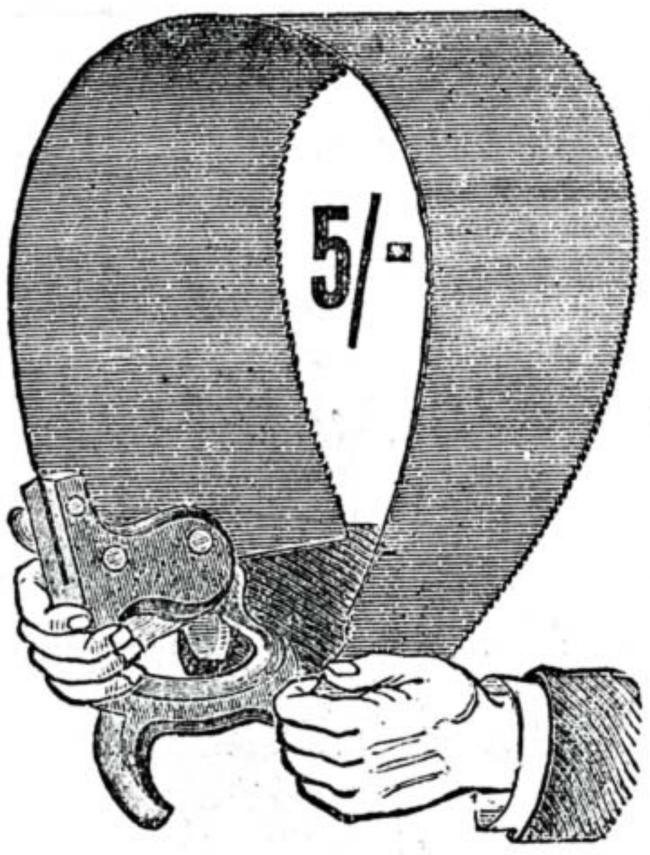

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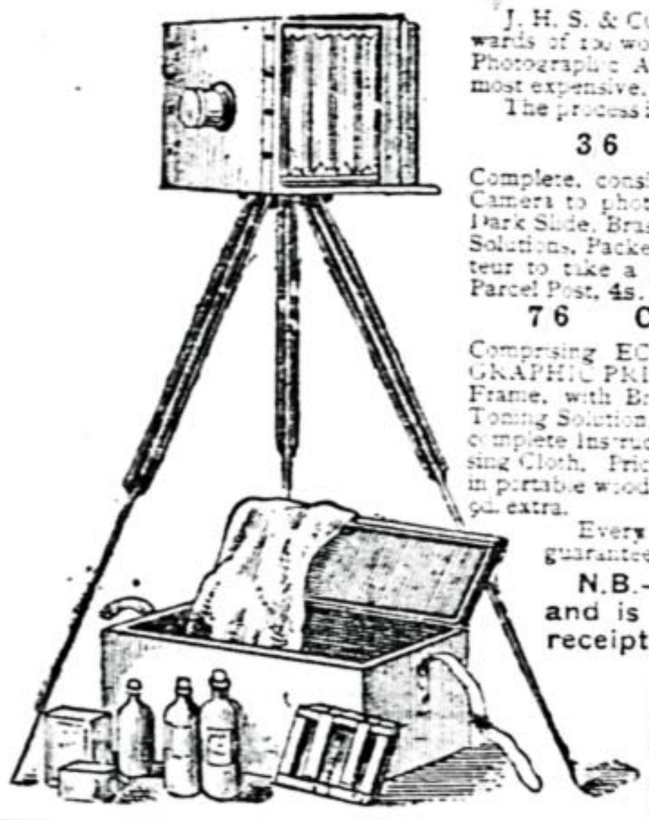

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